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NOMINAL CONTRACTING EFFECTS ON COMMON STOCK RETURNS: A MULTI-FACTOR MODEL APPROACH

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by

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ABSTRACT

This study examines the theoretical and empirical impact of nominal contracting effects on common stock real returns. It develops an arbitrage pricing model which has as its primary factors the market portfolio and expected inflation and unexpected inflation rates. It extends the model to test empirically for the impact of different nominal contracting effects. In particular, it examines the short- and long-term net monetary position effects, the depreciation tax effect, the inventory tax effect and the wage contract effect. A common feature among these effects is that they are nominal contracts whose real values are affected by unexpected inflation.

The study differs from previous studies by considering the effect of unexpected inflation beyond that already impounded in the market factor. It covers the period from 1964 through 1983 using quarterly data. The sample is selected from all non-regulated firms commonly listed on the 1983 versions of the Compustat Annual Industrial tape and the CRSP tape. Equally weighted and sequentially updated portfolios are formed in order to obtain more

stable betas. The methodology is based on French, Ruback and Schwert (1983).

The preliminary multifactor model analysiss shows that the three factors--the market factor, the expected inflation factor and the unexpected inflation factor--are significant in explaining common stock returns. The cross-sectional analysis between unexpected inflation betas and the nominal contracting effects shows that nominal contracting effects are empirically detectable and are consistent with the theory of inflation wealth transfer. The nominal contracting effects appear to have been undetected in previous research.

In further support for the nominal contracting hypothesis, the study performed maturity effect tests. According to these tests, the coefficient of a nominal contracting variable with longer term to maturity is larger (in absolute value) than the coefficient of a nominal contracting variable with shorter term to maturity. In general, the results from the maturity effect tests tend also to support the nominal contracting hypothesis.

CHAPTER 1

Introduction

The effect of inflation on common stock returns is of great interest to many researchers. This chapter reviews the main theories related to inflation effect on common stock returns and defines the objective of the current study.

Classical economists theorized the relation between inflation and common stock returns as if they believed a firm's portfolio consisted entirely of real assets. They predicted that common stocks represent a complete hedge against inflation. The value of real assets are expected to rise perfectly with any increase in the rate of inflation.[1]

The empirical evidence of a negative relationship between common stock returns and inflation came to be in sharp contrast to the argument held by classical economists. The negative relationship has been confirmed

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[1]This view is a generalization of the 'Fisher effect'. Fisher (1930) hypothesized that nominal interest rate must fully reflect expected inflation. The generalized form is that nominal returns on all securities must be related positively to expected inflation.

by Lintner (1975), Bodie (1976), Jaffe and Mandelker (1976) and Fama and Schwert (1977). Expected and unexpected inflation were found to be negatively correlated with the nominal and real returns of the aggregate stock market. Many researchers have offered different explanations to account for the contradiction between the empirical evidence and classical theory. They offered three classes of explanations: (a) macro-economic related theories, (b) the Modigliani-Cohn hypothesis and (c) the nominal contracting hypothesis.

The "macro-economic" hypotheses suggest reasons why inflation and returns on real assets might be negatively correlated. Fama (1981) suggested that the negative relationship can be explained by a coincident negative relationship between inflation and real output. When investors are expecting changes in inflation, then they are also expecting changes in the future real output and accordingly they are adjusting the common stock prices to reflect such expectations. Thus, inflation is indirectly related to aggregate common stock returns. Geske and Roll (1981) have proposed a "reverse causation" explanation.[2] The decline (increase) in the stock market signals a decrease (increase) in corporate earnings and employment. Consequently, it causes a decrease (increase) in government

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[2]Usually, a reverse causality is an indication of market efficiency. It means that it is possible to predict inflation from stock returns but never the reverse.

revenue from both personal and corporate taxes. This increases (decreases) the deficit in the government budget. In anticipation of balancing the government budget, investors expect a change in tax rates or a change in borrowing policies. Either change can affect the earnings of the firms. The "macro-economic" hypotheses concentrated mainly on explaining the effect of expected inflation on aggregate common stock returns.

Modigliani and Cohn (1979) argue that stock market investors are satisfied with lower real returns in inflationary periods because they are unable to distinguish real and nominal returns. Investors fail to anticipate the true economic value of the equities by committing two major errors. First, investors fail to convert reported accounting profits to their real values. Second, they use the nominal rate instead of the real rate as the capitalization rate of equity earnings. Their explanation contradicts the efficient market hypothesis and has been criticized by many authors.

The third potential explanation, the nominal contracting hypothesis, is the focus of this study. The preceding two theories accept the classical view that common stocks ultimately represent claims on a portfolio of real assets. In contrast, the nominal contracting hypothesis views a firm's portfolio as consisting of nominal as well as real assets and liabilities. Because the value of nominal assets and liabilities is sensitive to inflation, this allows inflation to affect the value of the firm.

Assuming rational expectations, expected inflation is fully considered in setting the terms of a nominal contract at the time the contract is signed. Thus, only unexpected inflation can affect the real value of a nominal contract. Two important points emerge from this analysis: (a) only unexpected inflation matters and (b) a firm's sensitivity to unexpected inflation depends on its nominal contracting positions. Unexpected inflation ought to help firms holding substantial nominal liabilities and harm those having relatively large quantities of nominal assets.

Because the first two explanations involve economy wide variables, empirical work on them is confined to time-series estimation of macro-economic variables. In contrast, nominal contracting variables differ cross-sectionally as well as over time. The research on this topic can be viewed as one of gradual discovery of additional variables and gradual increase in methodological sophistication. This literature is reviewed in detail in chapter 2. This study is concerned with investigating most of the nominal contracting effects considered in the literature. The nominal contracting effects of interest here are: the net monetary position effect, the depreciation tax effect, the inventory tax effect and the wage contract effect.[3]

Studies of the nominal contracting effects can at most provide eivdence on the presence or absence of nominal contracting effects. The absence of such effects would suggest that research should concentrate on the first two explanations. The presence of such effects would cast further doubt on the Modigliani-Cohn hypothesis because of its reliance on irrationality, which is incompatible with nominal contracting. Neither outcome would shed light on the existence of macro-economic effects or relative importance of the macro-economic explanations discussed above.

Surprisingly, the empirical work related to nominal contracting effects is still inconclusive if not puzzling. French, Ruback and Schwert (hereafter FRS) (1983) concluded that "wealth effects caused by unexpected inflation (nominal contracting effects) are not an important factor in explaining the behavior of stock prices." If the market is efficient, then common stock returns should reflect the nominal contracting effects.

This study contributes to the literature by producing stronger support to the nominal contracting hypothesis. In doing so it addresses a number of methodological issues

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[3]The wage contract effect is also referred to as the wage-lag effect.

which may have contributed to the weaker results of earlier work. These issues include:

1. The control for the effect of market risks on common stock returns.
2. The careful distinction between expected and unexpected inflation.
3. The consistent use of real returns.
4. In contrast to earlier work, the statistical analysis is performed to get the most out of the experimental design implied by forming the data into portfolios.

These issues are considered in detail in chapter 4. The first three issues have appeared individually in earlier work. This is the first attempt to pull them all together and add the fourth issue.

The remainder of this study is organized as follows. Chapter 2 reviews previous studies that are related to this study. Chapter 3 describes the data and the sample. Chapter 4 discusses the methodology. Chapter 5 presents the results. Chapter 6 concludes the study.

CHAPTER 2

Review of the Literature

This chapter reviews two main areas in finance related to the present study. First, it reviews the theoretical and empirical studies related to inflation effect on common stock returns, emphasizing the evolution of the methodology and model specification in previous studies. Second, it reviews the relatively recent development of asset pricing theory related to inflation effects. The two areas have been developed in isolation from each other. This chapter reviews both areas chronologically. The related studies can be classified into five time phases. In general, there was an increase in the set of variables examined and methodological sophistication. The final section summarizes the current "state of the art."

2.1 Earlier Cross-Sectional Studies (Studies Prior to 1968)

In the view of earlier cross-sectional researchers, nominal contracting effects would reinforce the classical prediction that inflation should have a positive effect on common stock returns. Of the four nominal contracting effects listed earlier, they considered the net monetary position (NMP) effect and sometimes the wage contract effect.

The NMP effect follows from the prediction that net debtor firms earn from unexpected increase in inflation while net creditor firms lose. Net debtor firms are those whose nominal liabilities exceed their nominal assets, while net creditor firms are those whose nominal assets exceed their nominal liabilities.[1] The NMP effect implies a wealth transfer from net creditor firms to net debtor firms. Net debtor firms earn from unexpected inflation because they are expected to pay back their debt with depreciated dollars. The wage contract effect predicts that the real value of wages decrease with unexpected increase in inflation. It implies a wealth transfer from laborers to firms. As firms are in general net debtors, earlier researchers view that the two effects support the classical theory.

Earlier studies have followed one of two related methodologies. First, the firms are grouped into two main groups: net debtor firms and net creditor firms. The performance of common stock prices of the two groups is compared in inflationary and deflationary periods. Appropriate statistical tests, such as Mann-Whitney and Sign tests, are employed to detect significant differences in the mean performance values of the two groups. Net

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[1]Nominal assets and liabilities are defined in chapter 3.

creditor firms are supposed to lose during inflationary periods and to gain during deflationary periods. On the other hand, net debtor firms are supposed to gain during inflationary periods and to lose during deflationary periods. <u>Second</u>, the results are strengthened by the use of rank correlation analysis. Firms are ranked from most extreme debtors to most extreme creditors. The correlation between these rankings and the performance of their corresponding stock prices are analyzed. Negative correlation between the two measures in inflationary periods and positive correlation between them in deflationary periods would validate the desired hypotheses.

One of the earliest studies that empirically tested the NMP effect was done by Kessel (1956). Kessel considered five samples. The first sample included only banks and the other four samples were selected randomly from industrial companies listed on the New York Stock Exchange. The banks (all of which were found to be net creditors) had shown an average increase in their stock prices of 47 percent during the period 1942-48. The other four samples were found to be divided equally between net debtors and net creditors. The net debtor firms had shown a stock price increase of 81 percent, while the net creditor firms had decreased by 13 percent. The banks in the sample had shown an increase in stock prices because banks are at the same time labor-intensive. Kessel considered this provided evidence for both the NMP and wage contract effects. However, he had failed to see that the two effects need to be tested separately. Alchian and Kessel (1960) have tested the two effects separately. After controlling for the NMP effect, they failed to find evidence to support the wage contract effect. While Alchian and Kessel (1959) and De Alessi (1963) have supported the NMP effect, Bach and Ando (1957) have obtained mixed results in three different sub-periods from 1939 to 1952.

Despite the relative crudeness of their methodology, earlier studies showed some evidence favoring the NMP effect. However, they failed to support the wage contract effect. Other nominal contracting effects were left unexplored. In their views, the evidence for the NMP effect lended support for the classical prediction of a positive relation.

2.2 The Combined NMP and Depreciation Tax Effect Studies (1968 - 74)

A. Theoretical background

Unfortunately for the classical viewpoint, the observed association between unexpected inflation and common stock returns proved to be negative. In response, studies in this period added the depreciation tax effect to the list of nominal contracting effects considered earlier. The depreciation tax shield is considered a nominal asset because taxes are based on the nominal value (historical costs) of the assets instead of their real value (current costs). Its effect is expected to be negative.

The depreciation tax effect hypothesis states that the taxes paid by the firm in real terms are positively related to the rate of inflation. During an inflationary period, the reported taxable earnings of the firm will be overstated because tax regulations are based on historical cost accounting rather than inflation adjusted accounting. Historical cost accounting underestimates the depreciation charges. The overstated earnings result in paying more taxes to the government. This hypothesis does not necessarily eliminate the NMP effect or the wage contract effect. It only implies that the positive effect from unexpected inflation will be potentially offset by a larger negative effect from taxes.

Nichols (1968) was the first to address the theory of the depreciation tax effect. He developed a model which includes the NMP effect and the depreciation tax effect. He demonstrated that the impact of unexpected inflation upon the real value of the firm depends on the relative strength of the two effects. He argued that the negative depreciation tax effect is significant and can explain the negative relation between unexpected inflation and common stock returns.

Motley (1969) argued that, in general, the depreciation tax effect acts to increase the cost of capital goods and services, consequently reducing the demand for new investment. That is, the depreciation tax effect has an even greater impact on the real value of firms in general than Nichols' theory predicted.

B. Empirical results.

Bradford (1974) considered empirically the test for the combined NMP and depreciation tax effect. His main analysis included a cross-sectional regression of common stock real returns on an inflation adjusted weighted measures the firms' NMP and depreciation tax positions. The model was tested in three periods: 1949-52, 1952-55 and 1948-56. His results supported the depreciation tax effect in the two periods 1949-52 and 1948-56 which had experienced relatively high inflation. Inflation in the period 1952-55 was almost negligible. There was no support for the NMP effect in any of the three periods.

To compare his results to earlier studies, Bradford conducted five additional tests. In those tests, the performance among four groups of firms classified according to their depreciation tax positions (high, low) and their NMP (High, low) were considered. Two other groups of firms were also considered based alone on the depreciation tax positions (all high depreciations firms, all low deprecia-tions firms). Among the tests used were the t-test, Mann-Whitney and the rank correlation tests. The results of those tests tended to support the results of the cross-sectional analysis.

His main conclusion was that the NMP effect is found no more to be significant when the depreciation tax effect was included. The inclusion of the depreciation tax effect has increased the power of the tests to detect the nominal contracting effects. The NMP and the depreciation tax effects need to be tested simultaneously.

2.3 Controlling for Market Risks (Single-Index CAPM, 1974-78)

A. Theoretical background.

All previous work cited until this period analyzed nominal (or real) common stock returns as a function of the nominal contracting variables. The theory of the single-index Capital Asset Pricing Model (CAPM) predicts that market returns have a significant role in determining common stock returns. The market portfolio controls for many macro-economic effects. Its exclusion may cause nominal contracting variables reflect spurious correlation with the market risk rather than the pure theoretical effects of the nominal contracting variables.

From a theoretical viewpoint, Rozeff (1977) considered the unexpected inflation effect on the market risk of a firm. His conclusions are quoted as follows:

a. The (market) beta coefficient of a stock should impound the firm's NMP. Therefore beta should be at least as good an ex ante predictor of cross-sectional variation in stock returns as NMP.

b. If beta impounds NMP, then the residual returns of stock after abstracting from beta should be unrelated to NMP.

c. NMP should be related to operating leverage and financial leverage.

d. Systematic risk should be related to NMP, with debtor firms having higher betas and creditor firms having lower betas.[2]

Since common stock returns are positively related to their systematic risks, then the bias from excluding the market risks is expected to be in the opposite direction to the signs of the nominal contracting variables. This weakens the significance of the nominal contracting effects.

B. Empirical results.

Among the studies that have recognized the importance of empirically controlling for market risks are those by Bach and Stephenson (1974), Hong (1977) and Freeman (1978). In this section, the first two studies are reviewed.

1. Bach and Stephenson (1974): They were the first to suggest that the market risk controls for other cyclical factors in determining common stock returns. After controlling for the market risk, they have expected "a purer test" to detect for inflation effects.

[2] Rozeff (1977), p. 161.

Firms were grouped according to their exposure to inflation on the basis of their net effect from the NMP and depreciation tax effects. The period 1955-70 and three subperiods: 1955-57, 1958-64 and 1965-70 were considered in the analysis. It was hypothesized that the single-index market model's residuals are likely to reflect the inflation effects. The market risk was estimated using data from the 30 preceding and 30 following months. The residuals for each month were calculated for each group and then averaged over the period under study. The performance measured by the residuals for the two groups was then examined.

The analysis was conducted twice. The first time, the market risks were excluded. The second time, the market risks were included. The major results have shown that after controlling for the market risk, the inflation effects are not found to be significant. The main conclusion was that the total effect of inflation "has been picked up" by the market risk coefficient.

2. Hong (1977): He conducted a more comprehensive study to test for the depreciation tax and NMP effects through the employment of the single-index CAPM. He also extended the theoretical

work of Nichols (1968) and Motley (1969) to include the inventory tax effect.

The inventory tax shield is also a nominal asset because in some cases the inventory valuation method is based on historical (original acquisition) costs instead of current costs, the cost of goods sold will then be understated. This will overstate the taxable income and firms will end up paying more taxes to government. Firms are allowed to use various inventory valuation methods. The inventory tax effect arises only when a firm uses the first-in first-out (FIFO) method instead of the last-in first-out (LIFO) method in the evaluation of its inventory. Firms which use LIFO method, reduce their inventory tax effect to zero.[3]

With respect to the empirical testing of the nominal contracting effects, Hong avoids the problem of using the residuals generated by the CAPM to compare the performance of firms with different nominal contracting positions. The residuals of the CAPM are assumed to be serially uncorrelated with mean zero and small variance. Thus, they are not supposed to capture any

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[3]Firms are still using FIFO because: 1) the cost of changing the inventory method is larger than the expected tax savings, 2) the ability to use it as a hedge against inflation-tax risks.

systematic effect such as inflation. Instead, Hong proposed a general cross-sectional model. The common stock nominal returns across firms can be explained by the market beta and three nominal contracting variables: the NMP, the depreciation tax and inventory tax variables.

Hong considered three different five-year periods: 1954-58, 1959-63 and 1964-68. The five-year periods were selected to provide adequate time to estimate the firms' market betas. The market betas were estimated by using the traditional market model with monthly data over the five year period. The nominal contracting variables were averaged on a yearly basis over the different five year periods. They were divided by the book value of the assets. This was done to facilitate comparison across firms. Grouping procedure was also followed to reduce biases in estimating the coefficients of the proposed model.

His results showed that the NMP effect has not been significant in all periods, the depreciation tax effect has been significant and negative (as hypothesized) in all periods and the inventory tax effect has been significant and negative in all but one period. when the market betas were not included, the NMP effect was found to be significant in two out of the three periods. This indicates that the systematic risk of a security has already impounded its NMP effect. As mentioned above, the use of debt increases the systematic risk of the security. The importance of this study is that it provides stable results.

To conclude, this group of studies demonstrated the importance of controlling for the market risk. By adding the market risk, the NMP effect seems to disappear. This suggests that earlier significance of the NMP effect has just been proxy for the market sensitivity. The inclusion of the market factor has resulted in providing a 'purer' test to detect the nominal contracting effects. The inflation effect was isolated from the non-inflation effects. This group of studies has also introduced the inventory tax effect and has maintained the depreciation tax effect.

2.4 Controlling for Real Returns (1972-82) (Inflation-Adjusted CAMP)

A. Theoretical background.

In a separate area of testing the nominal contracting hypothesis, many studies examined the effect of inflation on the single-index CAPM. The traditional CAPM developed by Sharpe (1964), Lintner (1965) and Mossin (1966) has implicitly assumed that the inflation rate is constant or that it does not have a significant effect. Roll (1972) was the first to address this issue. He derived an inflation adjusted CAPM assuming the existence of a risk free asset in real terms and risk aversive investors with quadratic utility functions. Long (1974), Chen and Bonness (1975), and Friend et al. (1976) derived other models under different assumptions and different specifications of utility functions. The major implication of these models is that they have considered a modified estimation of the standard market beta. Accordingly, the standard market beta and the standard CAPM residuals are considered to be biased.

The inflation-adjusted CAPM's have used similar procedures to those followed in deriving the standard CAPM. However, they have been different in their major assumptions:

1. Investors attempt to maximize the expected utility of their terminal real wealth.
2. Investors have homogeneous expectations about the expected mean and variance of the real return of an asset and the rate of inflation respectively.
3. Relative price changes are the same across goods and services. In other words, prices of all goods and services change at the same rate of the general price level.
4. The real interest rate is constant.

According to these assumptions, the derived market model in real terms becomes:[4]

$$R_{it} = b_0 + b^*_{im} R_{mt} + e_i \tag{2.1}$$

where

$$b^*_{im} = Cov(R_{it}, R_{mt})/Var\ (R_{mt}) \tag{2.2}$$

or in nominal terms:

$$r_{it} - \pi_t = b_0 + b^*_{im} (r_{mt} - \pi_t) + e_i \tag{2.3}$$

where

$$\begin{aligned} b^*_{im} = {} & [Cov(r_{it}, r_{mt}) - Cov(r_{it}, \pi_t) - \\ & Cov(\pi_t, r_{mt}) + Var\ (\pi_t)] \\ & /[Var(r_{mt}) - 2Cov(r_{mt}, \pi_t) + \\ & Var\ (\pi_t)] \end{aligned} \tag{2.4}$$

Comparing this to the traditional market beta:

$$b_{im} = Cov(r_{it}, r_{mt})/Var(r_{mt}) \tag{2.5}$$

From the point of view of the inflation adjusted CAPM, the traditional market beta, b_{im}, may be overestimated or underestimated depending on the value of the $Cov(r_{it}, \pi_t)$ and the $Cov(r_{mt}, \pi_t)$. The value b^*_{im} is identical to b_{im} when inflation is constant.

The $Cov(r_{it}, \pi_t)$ depends on the importance of the different effects of unexpected inflation among individual common stock returns. The value b_{im} would be overstated when $Cov(r_{it}, \pi_t)$ is greater or equal to zero and

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[4]The studies concerned with the inflation adjusted CAPM have derived different models depending on whether they are assuming the existence of a risk free asset in real or nominal terms or the existence of a zero-beta portfolio. For simplicity, the market model is assumed here and its results are expected to be the same as those of the different models.

understated when $Cov(r_{it}, \pi_t)$ is less than zero. The $Cov(r_{mt}, \pi_t)$ has also been shown to be significantly negative by studies done by Bodies (1976), Nelson (1976) and Jaffe and Mandelker (1976). In this case, b_{im} is expected to be understated. The main deficiency with the above models is that they assume an additional risk between inflation and common stock returns but they fail to consider a price for it.

B. Empirical results

Gilmer (1982) was interested in validating the following inflation related mechanisms: the long-term debt effect, the preferred stock effect and the depreciation tax effect.[5] For testing these hypotheses, he used two models: those of Hagerman and Kim (1976) and Stone (1974). The first model is of the form:

$$R_i = a_0 + a_1 h_j + a_2 b^*_i + e_i \tag{2.6}$$

where

h_j is an estimate of $Cov(R_i, \pi)$

b^*_i is estimated from the following equations:

$$b^*_i = b_i - (1-b_i)(c/(1-c))$$

where

b_i is the traditional beta.

c is $Cov(r_f, r_m)/Var(r_m)$.

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[5]The long-term debt and the preferred stock effects are usually included in the long NMP variable. When the long-term debt and the preferred stock are redeemable with a fixed dollar amount, they are considered to be nominal contracts.

The second model is the Stone two-index model:

$$\ln(R_{it}) = b_0 + b_i \ln(R_{mt}) + d_i \ln(R_{dt}) + e_i \qquad (2.7)$$

R_{mt} and R_{dt} represent the holding period returns on the stock market index and the bond market index, respectively. b_0, b_i and d_i are the coefficients of the model. This model is an extension of the traditional single-index market model to include an additional index, the bond market index.

Gilmer hypothesized that common stock real returns are cross-sectionally explained by the coefficients of the two factors included in each of the above two models and the nominal contracting variables. He employed the seemingly unrelated regression (SUR) and the random coefficient techniques to estimate the coefficients of the concerned cross-sectional models. He used monthly data over the period July 1978 to June 1981.

His results were mixed. They showed support for the long-term debt and the depreciation tax effects. The support for the former effect has been in sharp contrast to most previous studies which have found that after adjusting for the market betas, debt (or NMP) disappears. These results may be attributed to the use of real returns and the control for the market factor. Gilmer has ignored the effect of inflation on the first factor considered in the Hagerman-Kim model, namely the covariance between the return on common stock returns and the inflation rate

(h_j). He has also ignored the effect of inflation on the bond market index in the second model.

To conclude, failure to use real returns results in an additional spurious correlation between the nominal market returns and inflation. It makes the comparison of performance of firms in different inflation periods difficult to interpret.

2.5 Recent Studies (1982-84)

A. Inflation as a continuous variable.

Previous studies used data on inflation to examine performance of firms in high versus low inflation periods. By doing so, they have run into additional problems. The length of the periods (in some of the studies) and the intensity of inflation in such periods might vary significantly, resulting in biasing comparative results.

As inflation is a systematic (continuous) event, then it will be more appropriate that its effect be estimated from a direct association with common stock returns. Recent studies used multifactor models to estimate inflation betas. The single-index CAPM or the other forms of inflation-adjusted CAPM are inadequate to provide such estimates.

Many studies tested different multifactor models that include (actual) inflation factor or interest rates factors which are closely related to inflation. Most of them employed the SUR technique. The residuals of the multifactor models were assumed to be cross-sectionally correlated because of omitting common factors.

Gerlter and Grinols (1983) tested a multifactor model which includes the market factor, the inflation rate factor and the unemployment factor. In order to reduce the non-stationary status of the betas, they formed sixteen (4x2x2) portfolios according to the three factors' risk sensitivities. This was an extension of the procedure followed by Black, Jensen and Scholes (1972) and Fama and Macbeth (1973). The model was tested over the period 1970-80 using the SUR technique. The results showed that the macro-factors are statistically significant and their systematic risks are positively priced. The inflation betas were on average negative.

B. <u>Inflation decomposed into expected and unexpected components</u>.

Although previous studies have recognized the importance of unexpected inflation in their theoretical work, they have failed to adopt a direct measure of unexpected inflation in their empirical work in an appropriate way. They have implicitly assumed that during increasing inflationary (transitory) periods, investors would not anticipate the increase in inflation. Vice versa, during decreasing inflationary (or deflationary) periods, investors would not anticipate the decrease in inflation. Previous studies expected nominal contracting effects to occur in high inflationary periods and to disappear in low inflationary or deflationary periods.

Their results were in fact testing the relation between the actual level of inflation and the nominal contracting effects which the general theory does not imply. To avoid this problem, recent studies adopted a direct measure of unexpected inflation. They have also used it as a continuous variable.

Studies in mid-seventies started decomposing inflation into expected and unexpected components. Their objective was to examine the effect of each inflation components on the aggregate stock market returns. Some of the suggested models to decompose inflation are reviewed in chapter 3.

From a theoretical viewpoint, Elton, Gruber and Rentzler (1983) used the main Arbitrage Pricing Theory (APT) to incorporate the uncertain inflation effect. Their work has contributed significantly to the inflation incorporated asset pricing theory which started with Roll (1972). They considered an asset pricing model which includes as its factors: the market factor and unexpected (uncertain) inflation factor. They argued that the risks associated with the two factors are priced. The logic behind this is the absence of arbitrage profits as assumed by Ross (1976).

With respect to testing the nominal contracting effects, two studies emerged distinguishing between expected and unexpected inflation in their work. The two studies are those of French, Rubach and Schwert (1983) and

Bernard (1984).[6] Both studies hypothesized that nominal contracting effects ought to be reflected via unexpected inflation beta. In what follows, the two studies are reviewed in detail.

1. French, Ruback and Schwert (1983): They examined the nominal contracting effects on common stock returns concentrating on three effects: the long NMP, the short NMP and the depreciation tax effect. They realized that a more powerful test can be constructed through considering a direct association between common stock returns and unexpected inflation component. Their methodology is summarized as follows:

a. To estimate the direct association between common stock returns and expected and unexpected inflation components, the time-series regression model was considered:

$$r_{it} = \gamma_{0i} + \gamma_{1i}\,\delta_{et} + \gamma_{2i}\,\delta_{ut} + u_t \qquad (2.8)$$

where

γ_{0i}, γ_{1i} and γ_{2i} are the coefficients of the model.

r_{it} is the nominal quarterly return on stock i.

δ_{et} is the quarterly expected inflation component.

δ_{ut} is the quarterly unexpected inflation component.

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[6] Bernard's work was done independently while this study was in progress. He used similar technique and obtained more or less similar results.

u_t is the error term.

The results from testing this model showed that γ_{1i} and γ_{2i} are significant in explaining common stock returns. Expected and unexpected inflation were found to be negatively related to the nominal returns of the market index during the period 1947-79. When the model was tested with different portfolios of common stock returns, the unexpected inflation beta (γ_{2i}) was negative with portfolios with high net monetary positions and high depreciation tax positions and positive with portfolios with low net monetary positions and low depreciation tax positions. The effect of expected inflation was ignored.

b. To validate the desired nominal contracting hypothesis, a cross-sectional regression model was assumed:

$$\gamma_{2i} = a_{0i} + a_1 X_{1i} + a_2 X_{2i} + a_3 X_{3i} + e_i \qquad (2.9)$$

where X_1 is the long NMP, X_2 is the short NMP and X_3 is the depreciation tax effect. All are divided by the market value of stock of firm i in period t-1. The nominal contracting variables were estimated according to the latest previous fiscal year data. The constant term, a_{0i}, was assumed to vary across portfolios.

c. The final estimated model was then derived by substituting equation 2.9 into equation 2.8:

$$r_i = \gamma_{0i} + \gamma_{1i}\,\delta_{et} + [a_{0i} + a_1 X_{1i} + a_2 X_{2i} + a_3 X_{3i} + e_i]\,\delta_{ut} + u_{it} \quad (2.10)$$

where it was hypothesized that the coefficients a_1, a_2 and a_3 are negative. Long NMP (X_1) and short NMP (X_2) have been constructed in such a way that their values were negative. The coefficients were estimated by using the SUR technique.

d. Other tests were also conducted to confirm the results from model 2.10.

The results have shown little evidence to support the nominal contracting hypothesis. However, FRS have explained the "little evidence" as due to the two following reasons: (a) data on other nominal contracts were not included in the model, and (b) other macro-economic factors, not accounted for in their study, may have dominated the inflation effect and biased the results. They also interpreted the results as indirect support for the irrational hypothesis advanced by Modigliani and Cohn (1979). Actually, all studies that failed to support the nominal contracting hypothesis can be interpreted to lend support to the irrational hypothesis.

2. Bernard (1984): In a similar way to FRS (1983), Bernard tried to explain the cross-sectional differ-

ences between unexpected inflation rate and common stock returns. To estimate the unexpected inflation betas, he regressed common stock real returns on unexpected inflation. He suggested the inclusion of two additional factors besides the nominal contracting effects used by FRS. The first factor is related to the real cash flow from operations. The second factor is the market beta obtained from the standard single-index CAPM. It was hypothesized that the unexpected inflation beta is a function of the nominal contracting effects and the two factors. On the relation between the market beta and the long net monetary position, Bernard stated that "If systematic risk (the market beta) is omitted in the specification and LNMP (long net monetary position) serves partially as a proxy for that omitted factor, the estimated coefficient of LNMP could be biased upward, potentially causing a type II error."

The unexpected inflation betas were estimated for the period 1969-80 using quarterly data. The sample consisted of 136 firms which belong to 27 industries. Portfolios were constructed according to industries. The unexpected inflation betas were negative ranging from -0.29 to -23.91. His conclusion was that the significance and predicted signs of the net monetary positions (long and short) and the depreciation tax position were not consistent with the theory unless the other two factors were included in the model. The coefficients for the short NMP, the long NMP and the depreciation tax effect were -2.41, -2.14 and -1.62, respectively. These results are inconsistent with the maturity effect tests in which the coefficients of the long NMP and the depreciation tax effect should be larger than the coefficient of the short NMP. However, the results showed more support for the nominal contracting hypothesis than FRS's results.

To conclude, recent studies realized the importance of considering inflation as a continuous variable and of decomposing inflation into expected and unexpected components. They have also employed more sophisticated methodologies than previous studies. For instance, they employed pooled cross-sectional time-series analysis. Their empirical results seem inconclusive and puzzling. In general, the empirical work testing multifactor models with the inflation factor showed evidence to support the significance of the additional inflation factor.

2.6 Summary and Conclusion

The purpose of this chapter was to review the theory and empirical work related to unexpected inflation effects on common stock returns. The evolution of the theory and empirical work is a discovery and investigation of two main components: (a) the different aspects of firms' nominal contracting positions, and (b) the non-inflation factors that have an effect on common stock returns.

There were two main areas of interest. The first area included studies that have attempted various methodologies to empirically test for the nominal contracting effects. The second area included studies that have concentrated on examining the theoretical effect of inflation on asset pricing models. The interest in the second area started in the seventies.

To date, most of the analyses of the nominal contracting effects have used the traditional single-index Capital Asset Pricing Model (CAPM). The importance of using the CAPM is the ability to control for the market risk. As firms use debt as a hedge against inflation, they are also increasing their market risks. The level of the net monetary position (debt) determines the 'capital structure risk' of the firm. Rozeff (1977) showed that firms with large debts tend to have higher market betas than firms with low debts. At the same time, the level of net monetary position determines the wealth transfer effect caused by unexpected inflation as the net monetary position effect predicts. In the CAPM, the two effects are undistinguishable.

According to the CAPM, the market risk is also supposed to capture all systematic economic shocks such as inflation. The residuals generated from the CAPM are supposed to be serially uncorrelated and normally distributed with zero mean and small variance. Thus, their ability to capture systematic inflation effects is questionable. It is more appropriate to estimate the effect of inflation from a direct association with common stock returns (inflation or unexpected inflation betas).

Another important issue which emerged in the literature is the use of real returns instead of nominal returns. Failure to use real returns may produce additional measurement errors, particularly when the performance of firms is compared in different inflation periods. Furthermore, examining inflation effects on nominal returns may be inappropriate to measure rational investor behavior. Rational investors attempt to maximize their terminal wealth in real terms.

Most previous empirical studies failed to distinguish between expected and unexpected inflation. They were in fact testing the actual inflation effect instead of the unexpected inflation effect as predicted by the theory of nominal contracting

Recent studies showed tendency to employ more sophisticated methodologies. FRS (1983) and Bernard (1984) conducted their empirical work by employing estimates of unexpected inflation betas. They both treated unexpected inflation as a continuous variable. FRS showed no support for the nominal contracting hypothesis. They interpreted their results as due to missing nominal contracting variables and macro-economic variables. They did not control for other market effects and used nominal returns instead of real returns.

Bernard (1984) showed that the nominal contracting effects become significant once the market betas and cash flows from the operation were included in the analysis. He estimated the market betas by using the traditional CAPM. A potential error with this procedure is that the market betas were estimated under the implicit assumption that the nominal contracting effects captured by the CAPM residuals did not affect the estimates of the market betas. Since the market betas were used as observed variables, his study did also include an error-in-variables bias. Nevertheless, his results showed the strongest previous support for the nominal contracting hypothesis.

To conclude, the generally weak support for the nominal contracting hypothesis is surprising. The recent interest in the multifactor models and the recent development of the APT raises the questions of how to incorporate the inflation effect and how to make use of the multifactor model approach to test for the nominal contracting effects. The current study concentrates on answering those questions.

CHAPTER 3

Model Specification and Data

This chapter describes the proposed model and the data employed in the analysis. The first section presents the proposed multifactor model and discusses its specification. The second section discusses the expected signs and the relative magnitudes of the concerned coefficients. The third section lists the data sources, defines the covered period and describes the sample selection process. The fourth section discusses the model employed to estimate the expected and unexpected inflation rates and presents its results. The fifth section defines and discusses the variables employed in the multifactor model and the variables related to the nominal contracting hypothesis. The final section summarizes and concludes the chapter.

3.1 The Multifactor Model Specification

A. General model.

This study proposes to validate the nominal contracting effects through the employment of a multifactor model which has as its primary factors: the market factor and expected and unexpected inflation factors.[1] The multifactor model is:

$$R_{it} = \beta_0 + \beta_{mi}\,\delta_{mt} + \beta_{ei}\,\delta_{et} + \beta_{ui}\,\delta_{ut} + u_{it} \qquad (3.1)$$

where

R_{it} is the real return on security i during period t.

δ_{mi} is the real return on the market portfolio during period t.

δ_{et} is the expected inflation factor during period t.

δ_{ut} is the unexpected inflation factor during period t.

β_0 is a constant term.

β_{mi} is the market risk sensitivity of security i.

β_{ei} is the expected inflation risk sensitivity of security i.

β_{ui} is the unexpected inflation risk sensitivity of security i.

u_{it} is the error term.

Expected inflation is included in the model because previous studies have found that it is significant in explaining common stock returns. The market factor is included to control for the market risk and to capture other systematic economic shocks as discussed in chapter 2.[2]

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[1]The expected and unexpected inflation factors may be primary factors or correlated with primary factors. It is beyond the scope of this study to determine which case is the true one.

[2]Notice that the market beta of the multifactor model is completely different from the traditional market beta. There are two reasons for this. The first reason is that real returns instead of nominal returns of the market

The coefficient of the expected and unexpected inflation factors measure the "expected and unexpected inflation risk sensitivities" of a security beyond that already impounded in the market factor. The expected and unexpected inflation factors are orthogonal by construction. They may be correlated with the market factor at any point in time. The only necessary condition is that they are not perfectly correlated.[3]

Under nominal contracting theory, a firm's sensitivity to unexpected inflation depends on its nominal contracting positions. Accordingly, a cross-sectional model is assumed:

$$\beta_{ui} = a_0 + \sum_n a_n X_{ni} + e_i \tag{3.2}$$

where

β_{ui} is the unexpected inflation risk sensitivity of security i.

a_0 is the intercept term.

X_{ni} represents the n^{th} nominal contracting variable of firm i.

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portfolio and the common stock returns are considered. The second reason is that the covariances between the real market portfolio return and the unexpected and expected inflation components are considered in the estimation of the market betas. When both covariances are zero, the market beta will be identical to the traditional market beta. In this case, the multifactor model collapses to the traditional CAPM. Since the covariances between the real market portfolio return and the expected and unexpected inflation components are expected to be negative, then the market beta generated through the multifactor model tends to be larger than the traditional market beta.

[3]Elton, Gruber and Rentzler (1983), p. 526.

a_n is the coefficient of the n^{th} exposure variable.

e_i is the error term.

Two possible sets of nominal contracting variables (described later in this section) were used. This model assumes a linear relationship between the unexpected inflation betas and the different nominal contracting position variables. It implies that the larger the exposure variable value, the higher the security's unexpected inflation risk and the smaller the exposure variable, the lower that risk. The operational definitions of the variables will be stated in the fifth section of this chapter.

In order to obtain the final operational model needed to validate the nominal contracting effects, model 3.2 is substituted into model 3.1 to yield:

$$R_{it} = \beta_0 + \beta_{mi}\,\delta_{mt} + \beta_{ei}\,\delta_{et} + [a_0 + \textstyle\sum_n a_n X_{ni} + e_i]\,\delta_{ut} + u_{it} \qquad (3.3)$$

where X_{ni}'s are the variables which represent the exposure of firm i to nominal contracting effects as described above. The a_n's are restricted to be equal in the analysis while the market and expected inflation factors are allowed to vary across firms.

Model 3.3 predicts that a firm's common stock real returns depend on:

(a) The market portfolio real returns.

(b) The expected inflation rates.

(c) The interaction of the firm's specific nominal positions and the magnitude of unexpected inflation.

Model 3.3 was estimated as a one step procedure. Except for the expected and unexpected inflation rates, all of the independent variables in model 3.3 are observable.

B. <u>Specific models</u>.

This study considers most nominal contracting variables proposed in earlier studies. Because data are often not available on certain variables, two specifications of 3.2 were used. The first considers three nominal contracting variables: long net monetary position (LNMP), depreciation tax effect position (DEPT) and short net monetary position (SNMP). This model is:

$$R_{it} = \beta_0 + \beta_{mi}\,\delta_{mt} + \beta_{ei}\,\delta_{et} + [a_0 + a_1\ \ LNMP_i + a_2\ DEPT_i + a_3\ SNMP_i + e_i]\ \delta_{ut} + u_{it} \qquad (3.3a)$$

The second considers four nominal contracting variables: net monetary positions (NMP), depreciation tax effect position (DEPT), wage contract position (WAGE) and inventory tax position (INVT). This model is:

$$R_{it} = \beta_0 + \beta_{mi}\,\delta_{mt} + \beta_{ei}\,\delta_{et} + [c_0 + c_1\ NMP_i + c_2\ DEPT_i + c_3\ WAGE_i + c_4\ INVT_i + e_i]\ \delta_{ut} + u_{it} \qquad (3.3b)$$

As will be discussed later, the first model was estimated from the main sample while the second model was estimated from a subsample. The first model was considered because: (a) its sample contains more observations, and (b) it is comparable to most other studies. The second model has the advantage of considering more individual variables.

3.2 Expected Results

A. Expected signs of the coefficients.

The coefficient of the market factor, the unexpected inflation and the nominal contracting variables in models 3.1 and 3.3 are expected to be as follows:

1. The market beta is expected to be positive. Usually, a portfolio with a market beta larger than one is assumed to have a higher risk than the market portfolio. A portfolio which has a market beta smaller than one is assumed to have a lower risk than the market portfolio. A portfolio which has a market beta equal to one is expected to have the same risk as the market portfolio. As Rozeff (1977) predicted firms, with high debt (net debtor positions) tend to have a market beta larger than one and firms with low debt tend to have a market beta smaller than one.
2. Nominal contracting theory does not predict any effect of expected inflation on stock returns. In other studies, it has been consistently negative. This coefficient variable is not the focus of this study.
3. The unexpected inflation beta can have positive, zero or negative sign. A firm with neutral nominal contracting positions is expected to have a zero unexpected inflation beta. A firm with low nominal

contracting position is expected to have a positive unexpected inflation beta. And a firm with high nominal contracting positions is expected to have a negative unexpected inflation beta.

4. As will emerge in section 3.5, the nominal contracting variables are all defined to increase (decrease) with the magnitude of a firm's nominal assets (liabilities). Thus, their coefficients are negative if the nominal contracting hypothesis is valid.

B. <u>The relative magnitude of the coefficients (maturity effects)</u>.

The maturity composition of the nominal assets and liabilities of a firm plays an important role in determining its exposure to unexpected inflation effects. It is expected that the longer the term to maturity of a nominal contract, the larger the exposure of the contract to unexpected inflation effects. For instance, a creditor holding a long term contract is exposed to unexpected inflation for a longer period than a creditor holding a shorter term contract. With an unexpected increase (decrease) in inflation, the former creditor incurs more losses (gains) than the later one.

As the maturity structure of assets and liabilities differs from one firm to another, the unexpected inflation maturity effect will then significantly differ from one firm to another. For instance, a firm that uses short term debts (liabilities) to finance long term assets needs to reissue the short term debts continuously over the period of the average life of the assets. Each time the short term debts are reissued, they are reissued at an interest rate that reflects the current expected inflation. A firm which utilizes longer term debts to finance the same maturity structure of assets will benefit more from unexpected inflation than the former firm. Similarly, a firm which utilizes a shorter period for depreciation of its assets ends up paying less taxes than a firm which has similar structure of assets but utilizes a longer term for depreciation.

As a result of the maturity effect theory, the coefficient of a longer term to maturity variable is expected to be larger than the coefficient of a shorter term to maturity variable.[4] For instance, the coefficient of LNMP is expected to be larger than the coefficient of SNMP.

3.3 Data Sources and Sample

The data used in this study were obtained from three sources: (1) the daily Center for Research in Security Prices (CRSP) tape, (2) the annual Industrial Compustat tape, and (3) the Citibank Data Base tape. The CRSP tape was used to obtain quarterly data on common stock returns and the stock market indices. The Compustat tape was used to get data on individual firms. The items from the

[4]Because the maturity terms of the contracts which compose a variable were ignored, the maturity effect of a variable is expected to be reflected in the estimated coefficient of that variable.

Compustat needed in the computation of the exposure variables are listed in Table 3.1. The Citibank Database was used to obtain quarterly data on the macro-economic variables needed to estimate the expected and unexpected inflation components.

The period covered by the study is from the first quarter of 1964 through the last quarter of 1983. SAS software programs were used for all the computations and tests needed to validate the hypotheses in this study.

The sample was first selected from all non-regulated firms[5] listed on the 1983 version of the Compustat Annual Industrial tape.[6] The tape contains annual data on individual firms for the period 1963-82. All these data periods were needed for the estimation of the nominal contracting effects variables for the period under study 1964-83. As mentioned above, for a given year the nominal contracting positions of a firm were estimated from the previous year's item values.

The initial sample consisted of 1,959 firms, from which 31 were deleted because they had missing data during the entire period under study. Data with a month of fiscal

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[5]Regulated firms were excluded because they might behave differently and because some of their data on depreciation and inventory were not available on the Compustat tape. Excluded regulated firms were financial firms such as banks and insurance companies, oil and gas companies, utilities, transportation, broadcasting and communications.

[6]The number of firms on the Compustat tape may vary from one year to another. New firms may be added. Others may be excluded if they merged with other firms or if they went bankrupt.

year-end different from the month of fiscal year-end reported for the year 1982 were deleted. This was done in order to avoid interpolation or truncation of the data. In a given year, firms with missing data on any of the items needed to estimate the nominal contracting variables were also deleted. The final step in the sample selection procedure was the elimination of firms which were not listed in the CRSP tape. The CRSP daily tape, ending date of December 31, 1983, was used. The resulting sample consisted of 1,568 firms.

The data from the Compustat tape and the CRSP tape were first transformed into quarterly data as will be described in section 3.5. Second, they were merged together according to their company numbers and their sequence of time. In any quarter, firms with missing data in any of the two tapes were deleted. The merged data were finally merged with the aggregate quarterly data of the market index returns, the expected inflation component and the unexpected inflation component. Each observation of the final data was thus composed of the following: year, quarter, company number, industry number, security return, long net monetary position, short net monetary position, depreciation tax position, wage contract position, inventory tax position, the market index return, the expected inflation component and the unexpected inflation component.

Table 3.1

Compustat Data Items

Data Item	Tape Item Number
Inventory	3
Current Assets	4
Current Liabilities	5
Assets (total)	6
Plant and Equipment (net)	8
Long-Term Debt	9
Depreciation and Amortization	14
Number of Employees	29
Convertible Debt and Preferred Stock	39
Labor and Related Costs	42
Inventory Valuation Method	59
Deferred Taxes (Balance Sheet)	74

3.4 A Model for Expected and Unexpected Inflation Rates

As in most similar studies, a critical point is the decomposition of inflation rates into expected and unexpected components. The two components are not directly observable. Any estimates of the two components usually contain measurement errors.

A good criteria for an inflation prediction model is that the error terms should have "a mean close to zero, a low standard deviation, small autocorrelations, and the correlation between the prediction and the prediction error should be small."[7] With rational expectations, investors do not make systematic errors in their prediction.

Different methods were followed in previous research to estimate the expected and unexpected inflation rates. The three most widely used are the Fama model, the ARIMA (autoregressive-integrate moving average) model as described by Box and Jenkins (1976), and the Livingston survey. Jaffe and Mandelker (1976) and Fama and Schwert (1977), among others, used the Fama model. The Fama model assumes that expected inflation is fully reflected in the changes of a risk-free interest rate such as the three-month Treasury Bill. It implies that real interest rate is constant over time. Bodie (1976), Nelson (1976), and Schwert (1981), among others, used the ARIMA model. This model is based on the assumption that expected

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[7]Schwert (1981), p. 18.

inflation is related to previous periods' forecast error. It is based on actual inflation rates in earlier periods. The Livingston survey contains 1800 responses on inflation expectations for April and October in each year. The respondents typically use different estimation models. However, Figlewski and Wachtel (1981) showed that inflation expectations conducted by the Livingston survey are inconsistent with rational expectations.

This study uses the French, Ruback and Schwert (FRS) (1983) model:

$$\pi_t = a_0 + \sum_{i=1}^{3} a_i \pi_{t-i} + b_1 TB_t + \sum_{j=1}^{2} b_{2j} IP_{t-j} + \sum_{k=1}^{2} b_{3k} MB_{t-k} + e_t \qquad (3.4)$$

where

π_t is the quarterly inflation rate in quarter t.

π_{t-i} is the quarterly inflation rate in quarter t-i.

TB_t is the yield to maturity on a three-month Treasury Bill maturing at the end of quarter t.

IP_{t-j} is the quarterly growth rate of the industrial production in quarter t-j.

MB_{t-k} is the quarterly growth rate of the monetary base in quarter t-k.

a_0 is the constant intercept term.

a's and b's are the coefficients of the corresponding variables.

e_t is the error term with mean zero.

The data used in estimating model 3.4 were obtained from the Citibank Database tape. All the data were available for the period under study. The data on the industrial production and the monetary base were seasonally adjusted.

There are many measures used to estimate the inflation rate. The commonly used measures are the Consumer Price Index (CPI), the deflator for the personal consumption component of gross national product and the deflator for the nondurable goods component of personal consumption. FRS have tested the three measures and have found that the CPI outperformed the other measures. They also tested the model for stability in the periods 1947-79 and 1964-79, and they found that it is stable.[8] They have also found that the error terms are not systematically correlated. The inflation rate is defined as:

$$\pi_t = (CPI_t - CPI_{t-1})/CPI_{t-1} \qquad (3.5)$$

where

π_t is the inflation rate during period t.

CPI_t is the Consumer Price Index at the end of period t.

The yield to maturity on the three-month Treasury Bill is known at the beginning of quarter t and so it is used to predict the inflation rate of the same quarter. When the expected future inflation rate is high, the current nominal interest rate increases to reflect the level of expected inflation. The yield to maturity on the three-month

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[8]The second period 1964-79 is close to the period 1964-83 which is considered in this study.

Treasury Bill reflects the expected inflation rate and the expected real interest rate for the next three months.

The quarterly growth rate of the industrial production is defined as:

$$IP_t = (IPL_t - IPL_{t-1})/IPL_{t-1} \tag{3.6}$$

where

IP_t is the industrial production growth during period t.

IPL_t is the industrial production level for nondurable consumption goods at the end of period t.

The quarterly growth rate of the monetary base is defined as:

$$MB_t = (MBL_t - MBL_{t-1})/MBL_{t-1} \tag{3.7}$$

where

MB_t is the monetary base growth during period t.

MBL_t is the monetary base level at the end of period t.

An advantage of model 3.4 is that it does not assume that the real interest rate is constant. When the coefficient $b_1 = 1$ and all the other coefficients are zero, then it becomes the constant real interest rate model assumed by Fama (1975) and Fama and Schwert (1977). Another advantage is that it includes other macro-economic variables that have been found to affect inflation rate expectations. The estimated (fitted) values of the quarterly inflation rate were used to estimate the expected inflation component and the residuals of the model were used to estimate the unexpected inflation component.

Table 3.2

Estimation of Unexpected Inflation Component Rate* **
(Quarterly Data)

$$\pi_t = a_o + \sum_{i=1}^{3} a_i \, \pi_{t-i} + b_1 TB_t + \sum_{j=1}^{2} b_{2j} IP_{t-j} + \sum_{k=1}^{2} b_{3k} MB_{t-k} + e_t$$

Estimation Period	a_0	a_1	a_2	a_3	b_4	b_{21}	b_{22}	b_{31}	b_{32}
1947-1983	-.003 (.001)	.317 (.082)	.013 (.083)	.382 (.080)	.175 (.102)	.088 (.071)	.092 (.073)	.081 (.045)	.120 (.044)
	R^2 = .64		F = 30.10		SSE = .0053				
1964-1983	-.006 (.003)	.425 (.120)	.063 (.124)	.339 (.119)	.058 (.117)	.313 (.117)	.064 (.121)	.037 (.056)	.092 (.056)
	R^2 = .68		F = 18.88		SSE = .0021				

* The correlation between the expected inflation estimates from the two models is 0.977. The correlation between the unexpected inflation estimates from the two models is 0.946.

** Standard errors are in parantheses.

Table 3.2 presents the regression analysis of model 3.4 for the two periods: 1947-83 and 1964-83. The analysis shows that the model is sufficiently specified. The correlation between the unexpected inflation estimates from the two models is extremely high (0.946). The results from Table 3.2 show that the Fama model and the ARIMA model are not valid because the coefficients of some of the other macro-economic variables were found to be significantly different from zero.

The results from the model in period 1964-83 were used in this study. The trend of inflation rate in this period can be described in three different subperiods: 1964-70, 1971-74 and 1975-83. The 1964-70 period experienced relatively low inflation rates. The 1971-74 period experienced stable inflation rates because of the wage and price control policy imposed by President Nixon. This policy extended from August 1971 to April 1974. The 1975-83 period experienced higher inflation rates.

3.5 Variables

A. The Dependent Variable.

The dependent variable incorporated in the analysis is the holding period real return (HPRR) which was computed as:

$$HPRR_{i,t} = HPR_{i,t} - \pi_t \qquad (3.8)$$

where

$HPR_{i,t}$ is the holding period nominal return (HPR) of security i during quarter t.

π_t is the inflation rate during the same period t.

The holding period nominal returns were first estimated by considering the geometric mean of the daily nominal returns obtained from the CRSP tape. Then, they were converted into real terms by subtracting the quarterly inflation rate from the quarterly nominal returns. The quarterly inflation rate was computed as:

$$\pi_t = CPI_t - CPI_{t-1}/CPI_{t-1} \tag{3.9}$$

where

CPI_t is the Consumer Price Index level at the end of period t.

CPI_{t-1} is the Consumer Price Index level at the end of period t-1.

B. The Multifactor Model Variables.

1. The market factor: The equally weighted index with dividends of all stocks listed on the New York Stock Exchange was used as a proxy of the market portfolio. The returns on the market index were obtained from the daily CRSP tape. The quarterly returns on the market index were first estimated by considering the geometric mean of the daily returns. Then, they were converted into real terms by subtracting the quarterly inflation rate (π_t) from the quarterly nominal returns. Because in many cases the empirical results were sensitive to the choice of the market index, the value weighted index with

dividends of all New York Stock Exchange stocks was also considered.[9]

2. <u>The expected and unexpected inflation factors</u>: As mentioned above, the expected and unexpected inflation estimates generated from model 3.4 were used as proxies for the expected and unexpected inflation factors.

C. <u>The Nominal Contracting Effects Variables</u>.

The data for all the nominal contracting variables were obtained from the annual Industrial Compustat tape. They were available on an annual basis at the end of the fiscal year of the concerned firm. The exposure variables in a given quarter were estimated according to the latest previous fiscal year data. This can be done because there should not be much variation in the relative exposure variables of the firms from one quarter to another. This also implies that investors form their expectations based upon all published information given by the firms. In case there was a significant change in one of the exposure variables during a quarter, then its effect would be reflected in the unsystematic risk component (error terms) rather than the systematic risk component. When portfolios were considered instead of individual stocks, the effect on the error terms would be almost negligible.

The nominal contracting variables were defined to increase with a firm's nominal assets and decrease with its

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[9]Roll (1977).

nominal liabilities. The net monetary position was estimated as nominal assets minus nominal liabilities. The wage contract variable was estimated in its negative value. The relative values of all the nominal contracting variables were used. These were computed by dividing the values of the variables by the book value of total assets. The relative values were considered for three reasons: (1) to facilitate comparison among firms, (2) to avoid possible heretoscedasticity, and (3) to indirectly adjust for the use of nominal measures instead of real measures in estimating the exposure variables.

1. Net monetary positions variables: The net monetary position of a firm was estimated as the difference between its nominal assets and its nominal liabilities. Because of lack of data availability, there were some practical difficulties in distinguishing between nominal and real assets and liabilities. Preferred stocks and convertibles were some examples. However, the book value of the preferred stocks and convertibles were considered as nominal liabilities. For the same reason, the book value instead of the market value of debt and other nominal assets and liabilities was used. Freeman (1978) exmained the book value of debt and its market value for the period 1961-75 and found that the two variables were highly correlated.

A firm's short net monetary position (SNMP) was defined as:

$$SNMP_{i,t} = (SMA_{i,t-1} - SML_{i,t-1})/TA_{i,t-1} \quad (3.10)$$

where

$SMA_{i,t-1}$ is the current assets less inventory of firm i.

$SML_{i,t-1}$ is the current liabilities of firm i.

$TA_{i,t-1}$ is the total assets of firm i.

All defined during quarter t-1. Any nominal asset or nominal liability with a maturity of one year or less is included in the computation of the short net monetary position vaiable.

A firm's long net monetary position (LNMP) was defined as:

$$LNMP_{i,t} = -(P_{i,t-1} + D_{i,t-1})/TA_{i,t-1} \quad (3.11)$$

where

$P_{i,t-1}$ is the book value of preferred stock of firm i.

$D_{i,t-1}$ is the book value of debt of firm i.

All defined during quarter t-1. According to this estimation, LNMP is negative or equal to zero.

A firm's net monetary position (NMP) was defined as the sum of its short net monetary position and its long net monetary position. That is:

$$NMP_{i,t} = SNMP_{i,t} + LNMP_{i,t} \quad (3.12)$$

2. <u>Depreciation tax position</u>: Because firms are allowed to use different methods of depreciation for tax purposes, the computation of the depreciation tax effect is not a direct one. FRS (1983) have suggested the following estimation which was also used in this study:

$$DTX_i = PE_i - 2DT_i \qquad (3.13)$$

where

DTX_i is the depreciation tax position of firm i.

PE_i is the book value of plant and equipment of firm i.

DT_i is the deferred tax account of firm i.

In this estimation, there are two assumptions. First, the deferred tax account is assumed to be solely composed of the depreciation tax treatment of the firm's assets. The second assumption is that the corporate tax rate is 50 percent. A firm that is taking advantage of the accelerated depreciation methods will end up paying less in taxes. Its depreciation tax exposure needs to be adjusted by the before-tax deferred tax account. Accordingly, the relative value of the depreciation tax position (DTAX) was estimated as:

$$DTAX_{i,t} = (PE_{i,t-1} - 2DT_{i,t-1})/TA_{i,t-1} \qquad (3.14)$$

The terms are as defined above.

3. <u>Wage contract position</u>: Because the actual value of firms' wage contracts are not available on the

Compustat tape, the wage contract position was estimated by considering the negative value of the number of employees. This might be a poor proxy for the wage contract position. Firms with large numbers of employees pay cheaper wages than firms which are capital intensive and have relatively small number of employees. The wage contract variable (WAGE) was then estimated as:

$$WAGE_{i,t} = -W_{i,t-1}/TA_{i,t-1} \qquad (3.15)$$

where

$W_{i,t-1}$ is the number of employees for firm i during period t-1.

4. <u>Inventory tax position</u>: The inventory value of a firm using FIFO method was used in estimating the inventory tax position of a firm:

$$INVT_{i,t} = I_{i,t-1}/TA_{i,t-1} \qquad (3.16)$$

where

$INVT_{i,t}$ is the inventory tax position of firm i.

$I_{i,t-1}$ is the inventory value of firm i.

As hypothesized above, if a firm is using LIFO then there will not be any inventory tax effect on the firm. When inventory tax effect was introduced in the analysis, all the firms which are using an inventory evaluation method other than FIFO were deleted. This had a substantial effect in reducing the original sample to its third size. Firms which changed their inventory evaluation methods during the covered period were also deleted in the sample. Such firms might have changed their behavior during that period. There might be a shift in their unexpected inflation betas.

3.6 Summary and Conclusion

This chapter presented the proposed multifactor model and described the data utilized in the analysis. The proposed multifactor model included three factors: the market factor, the expected inflation factor and the unexpected inflation factor. It was then extended to test for the nominal contracting effects. The major hypothesis in this study is that a firm's unexpected inflation beta reflects the exposure of its nominal contracting positions to unexpected inflation.

The data used in this study were obtained from three sources: (1) the daily Center for Research in Security Prices (CRSP) tape, (2) the annual Industrial Compustat tape, and (3) the Citibank Database tape. The study covers the period from 1964 through 1983 using quarterly data. The sample was selected from all non-regulated firms commonly listed on the 1983 versions of the Compustat Industrial tape and the CRSP tape.

The FRS (1983) model was used to estimate the expected and unexpected inflation rates. The equally weighted index of New York Stock Exchange was used as a proxy for the market portfolio. Quarterly returns on common stocks and the market index were first estimated by considering the geometric mean of the daily returns from the CRSP tape. Second, they were converted into real terms by subtracting the quarterly inflation rate from the quarterly nominal returns. In a given quarter the nominal contracting variables were estimated from the latest previous fiscal year data available on the Compustat tape. The study considered most nominal contracting variables proposed in earlier studies.

CHAPTER 4

Methodological Issues

This chapter describes the methodology used in testing the proposed nominal contracting hypotheses. The first section discusses the seemingly unrelated regression technique used in the testing process. The second section describes the formation and properties of portfolios which are mainly formed to reduce the nonstationarity bias of the coefficients estimated. The fourth section describes the maturity effect tests. The final section summarizes and concludes the chapter.

4.1 Seemingly Unrelated Regression

A potential problem in estimating model 3.3 is that its error terms are cross-sectionally correlated. This is because factors not included in the model may simultaneously affect the returns of many firms. For instance, Roll and Ross (1980), testing the APT, have found that there are at least four (unidentified) common factors. Chen, Roll and Ross (1983) have found many macro-economic variables other than inflation that have systematic relations with common stock returns. Likewise, firms with similar omitted nominal contracting positions will also tend to have cross-sectionally correlated error terms. The effect of the omitted common factors is reflected in the error terms. Firms within certain groups tend to have common characteristics because they hold similar assets, are subject to similar regulations or have similar production conditions. As a result, the successive error terms of such firms tend to be cross-sectionally correlated. In this study, the seemingly unrelated regression (SUR) technique developed by Zellner[1] was employed to avoid the cross-sectionally correlated error terms problem.

The SUR technique has been widely used in studies investigating the inflation effect on common stock returns as well as studies testing multifactor models. Gilmer (1982) and FRS (1983), among others, used the SUR technique to validate the nominal contracting hypothesis. On the other hand, Bonomo and Tanner (1983), Gerlter and Grinols (1982), among others, applied the SUR technique to multifactor models. The main assumption in all of these studies is that the residuals of their models are cross-sectionally correlated due to missing common factors.

Under these conditions, the SUR technique produces more efficient estimates by exploiting information about

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[1]Zellner (1962).

the error correlation structure. First, model 3.3 is estimated separately for each security (or portfolio) by Ordinary Least Squares (OLS) to obtain the error term (u_{it}). The estimated error terms will be used to estimate the covariances σ_{ij} as:

$$\sigma_{ij} = (1/(T-K)) \sum_{t=1}^{T} u_{it}\, u_{jt}$$

where K is the number of parameters to be estimated in model 3.3 and T is the number of observations in each time-series regression equation. The N time-series regression equations will then be pooled and reestimated using the matrix of estimated σ_{ij} to transfer the original observations into a system of equations with uncorrelated residuals. The SUR technique deals with systems of equations as one equation. When portfolios are used in estimating model 3.3, the use of the error correlation structure is appropriate since error terms tend to be highly correlated.[2]

There are two limitations on using the SUR technique. First, the covariance-variance matrix of each of the time-series equations should be constant. This might impose some limitations on the results. Second, the SUR technique requires the number of time-series regression equations to be less than the number of observations in each of the time-series regression equations. Since

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[2]Collins and Dent (1983) show that increasing the number of securities in portfolios results in "higher levels of cross correlation at the portfolio level as compared with the individual security level."

there are eighty observations (there are eighty quarters in the period covered) in each of the time-series regression equations, then the number of time-series regression equations should be less than eighty. Equally weighted and updated portfolios are used to reduce the number of cross-sectional regression equations.

4.2 Portfolio formation

A. Formation rules

A potential problem in estimating the risk sensitivities (betas) in models 3.1 and 3.3 is that they are not stable over time. The same problem arises in estimating the market beta in the single-index CAPM. Black, Jensen and Scholes (1972) and Black and Scholes (1974) have suggested the use of portfolios instead of individual securities. Portfolios tend to have more stable betas than individual securities. As mentioned above, Gerlter and Grinols (1983) have extended the procedure of Black, Jensen and Scholes to a multifactor model. Thus, the use of portfolio rather than individual security data is dictated both by the desire to have stable coefficients and by the practical requirements of the SUR technique. In the current study, the portfolios were constructed according to the firm's nominal contracting positions.

To insure stability of portfolio betas, portfolios should consist of firms with similar characteristics in nominal contracting positions. That is, dispersion of nominal contracting variables within portfolios should be minimized. While firms may change their nominal contracting positions from one period to another, portfolios will be constructed in such a way that their main characteristics in nominal contracting positions are relatively stable over time.

At the same time, the portfolios need to be constructed in such a way that the dispersion of nominal contracting variables across portfolios is maximized. By maximizing the variation in the data (the portfolios), this leads to more powerful tests to detect nominal contracting effects.

In estimating models 3.3a and 3.3b, twenty-seven and thirty-six portfolios were used, respectively. In what follows the description of the thirty-six portfolios is presented. Construction of the twenty-seven portfolios followed an analogous procedure.

According to the above criteria, four steps were followed in the construction of the portfolios. First, the firms were ranked from high to low (in absolute values) according to the first nominal contracting position, namely, the net monetary position. They were then divided equally into three groups: high (H), medium (M), and low (L). Second, the firms within each of the three groups were ranked from high to low according to their depreciation tax positions. They were divided equally into nine groups (HH, HM, HL, MH, MM, ML, LH and LL). Third, the firms were ranked from high to low according to their wage contract positions. Each of the nine groups were divided equally (high or low) into two more groups. Finally, the firms were ranked according to their inventory tax positions an they were divided equally (high or low) into two more groups. As a result, a total of 36 portfolios (3 x 3 x 2 x 2) were constructed.

The portfolios differ widely in their nominal contracting positions. They are constructed from all possible combinations of the four nominal contracting positions ranging from high levels of nominal contracting posistions (H H H H) to low levels of nominal contracting positions (L L L L). The dispersion is maximum for the first nominal contracting position (the NMP) and it decreases as one moves from the second nominal contracting position to the fourth one. The magnitude of dispersion is consistent with the magnitude of time to maturity for the different nominal contracting positions. For instance, the NMP is expected to have a longer time to maturity (one year to ten or more years), while the wage contracts are less expected to have a shorter time to maturity (one year or less). As mentioned above, this is important because is is expected that the longer the term to maturity of a nominal contract, the larger the impact from unexpected inflation; and the shorter the term to maturity of a nominal contract, the smaller the impact from unexpected inflation.[3] As a result, the coefficient of longer term to maturity variable tends to be more precise than the coefficient of shorter term to maturity variable. That is, net monetary position and depreciation tax effect tend to have more powerful tests than the other effects.

The portfolios were updated in every quarter. This is necessary to adjust for possible changes in the firms' nominal contracting positions and to keep the portfolios as similar as possible in their nominal contracting positions. Firms may be dropped from (or added to) portfolios for two reasons: (a) if there is a significant change in at least one of their nominal contracting positions, or (b) if their data are missing in that quarter. Accordingly, the number of firms in each portfolio could vary from one period to another. In each quarter, portfolios had almost the same number of securities.[4]

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[3]The portfolios could have been selected so as to have the same dispersion in all four nominal contracting positions. But this was not done so that there would be no empty portfolios or portfolios that included very few number of firms. The SUR method works better with equal cells. Since the firms are not expected to be divided equally according to the inventory tax positions (into FIFO and LIFO users), the desired portfolios may not have an equal number of securities. One way to deal with this problem is to eliminate firms using LIFO from the sample. This has been done in this study.

[4]If the total number of securities in a quarter is not a multiple of 36, then some of the portfolios tend to have one less security than the others in their compositions.

When portfolios are used as if they were individual securities, the final operational models 3.3a and 3.3b become as follows:

$$R_{pt} = \beta_0 + \beta_{mp}\,\delta_{mt} + \beta_{ep}\,\delta_{et} + (a_0 + a_1\,LNMP_p + a_2\,DEPT_p + a_3\,SNMP_p + e_p)\delta_{ut} + u_{pt} \qquad (4.1a)$$

and

$$R_{pt} = \beta_0 + \beta_{mp}\,\delta_{mt} + \beta_{ep}\,\delta_{et} + (c_0 + c_1\,NMP_p + c_2 DEPT_p + c_3\,WAGE_p + c_4\,INVT_p + e_p)\,\delta_{ut} + u_{pt} \qquad (4.1b)$$

where all the items are defined for portfolios instead of securities. The R_{pt} is defined as the arithmetic average of the holding period return of the individual securities which comprise portfolio p during period t. The exposure variables of the protfolios are defined as the arithmetic mean (equally weighted) of the exposure variables of the securities which comprise the corresponding portfolios.

For the reasons cited above, the residuals in models 4.1a and 4.1b are expected to be cross-sectionally correlated and the SUR technique is also justified. The coefficients of the exposure variables of the portfolios are also assumed to be constant across portfolios and over time. Their signs are also as predicted above.

B. Portfolio properties.

As mentioned above, this study was carried out in two parts. First, portfolios were based on only three nominal contracting variables: SNMP, LNMP and DEPT. They were formed according to LNMP, DEPT and SNMP, respectively.

Their number was 27 (3 x 3 x 3). The first sample contained 59,397 observations. Because of the nature of the data, the number of firms ranged from 226 in one quarter to 1,052 in another. Accordingly, the number of firms in the portfolios ranged from nine firms in some of the quarters to 39 firms in others. For the second part of the study, a subsample (the second sample) of 19,573 observations was used, which considered all the nominal contracting variables described above. It included the variables NMP, DEPT, WAGE and INVT. The number of firms ranged from 72 in one quarter to 427 in another. The number of firms in the portfolios ranged from two in some of the quarters to 12 in others. In the second sample, 36 (3 x 3 x 2 x 2) portfolios were formed. The difference between the two samples is that in any given quarter, firms with missing data on wage and inventory variables were deleted in the second sample. Firms which use an inventory valuation method other than FIFO were also deleted in the second sample.

The sample means and the standard deviations of each of the nominal contracting variables of the first and second samples are presented in tables 4.1 and 4.2, respectively. Tables 4.1 and 4.2 show that there are significant differences in the composition of the nominal contracting variables among the portfolios. It is expected that the dispersion in the composition of the portfolios is

Table 4.1

Means and Standard Deviations of Nominal Contracting Variables*
(27 Portfolios)

Portfolio**	LNMP	DEPT	SNMP
1	-0.03909	0.47363	0.19155
	(0.04121)	(0.10843)	(0.07952)
2	-0.05560	0.51903	0.06621
	(0.04263)	(0.13337)	(0.03655)
3	-0.06008	0.49498	-0.06499
	(0.04261)	(0.12195)	(0.08672)
4	-0.03333	0.28809	0.26322
	(0.03844)	(0.03908)	(0.08889)
5	-0.05299	0.29424	0.11215
	(0.04269)	(0.03836)	(0.05327)
6	-0.05638	0.29148	-0.07925
	(0.04299)	(0.03878)	(0.12021)
7	-0.02158	0.14340	0.37360
	(0.03470)	(0.05861)	(0.11250)
8	-0.04180	0.16151	0.15649
	(0.04005)	(0.05318)	(0.07335)
9	-0.04946	0.15642	-0.09858
	(0.04063)	(0.05555)	(0.14969)
10	-0.18662	0.56842	0.12085
	(0.04463)	(0.12139)	(0.05748)
11	-0.19384	0.59167	0.03740
	(0.03966)	(0.13289)	(0.02383)
12	-0.19200	0.57832	-0.05904
	(0.03965)	(0.12305)	(0.06665)
13	-0.18071	0.34786	0.15741
	(0.04262)	(0.04487)	(0.06401)
14	-0.18474	0.35509	0.04745
	(0.04300)	(0.04649)	(0.03298)
15	-0.18543	0.35030	-0.08743
	(0.04172)	(0.04679)	(0.08668)
16	-0.17978	0.19669	0.21061
	(0.04201)	(0.05785)	(0.09217)
17	-0.18720	0.21121	0.06261
	(0.04298)	(0.04992)	(0.03803)
18	-0.18208	0.19555	-0.10769
	(0.04259)	(0.05899)	(0.09336)
19	-0.37046	0.62832	0.09316
	(0.12128)	(0.12169)	(0.05428)
20	-0.38067	0.69346	0.01275
	(0.12727)	(0.14119)	(0.02627)
21	-0.40506	0.66151	-0.07843
	(0.13270)	(0.14099)	(0.07468)

Table 4.1(continued)

Portfolio**	LNMP	DEPT	SNMP
22	-0.37384	0.37836	0.15293
	(0.13068)	(0.05667)	(0.06449)
23	-0.36064	0.38074	0.04631
	(0.11914)	(0.05489)	(0.02961)
24	-0.36044	0.38840	-0.07240
	(0.10747)	(0.05915)	(0.08342)
25	-0.41942	0.20039	0.22081
	(0.24484)	(0.06311)	(0.09663)
26	-0.374421	0.21338	0.06402
	(0.12366)	(0.05874)	(0.03424)
27	-0.38066	0.21012	-0.08196
	(0.15551)	(0.06462)	(0.08544)

* Standard deviaitons are in parentheses.

** Portfolios are ranked from (H,H,H) to (L,L,L) according to LNMP, DEPT, and SNMP, respectively.

Table 4.2

Means and Standard Deviations of Nominal Contracting Variables*
(36 Portfolios)

Portfolio**	NMP	DEPT	WAGE	INVT
1	0.07350	0.38042	-0.03017	0.28452
	(0.08151)	(0.07438)	(0.01136)	(0.06867)
2	0.13669	0.45129	-0.02478	0.14022
	(0.14146)	(0.15915)	(0.00987)	(0.06638)
3	0.06110	0.37499	-0.05929	0.32812
	(0.07273)	(0.06932)	(0.02750)	(0.05066)
4	0.08236	0.41925	-0.05960	0.18282
	(0.09433)	(0.10973)	(0.03138)	(0.07508)
5	0.12534	0.24487	-0.03023	0.33481
	(0.11691)	(0.03251)	(0.01328)	(0.06634)
6	0.18938	0.25041	-0.02704	0.18568
	(0.15023)	(0.03696)	(0.01186)	(0.07998)
7	0.09406	0.23522	-0.05669	0.37242
	(0.10193)	(0.03636)	(0.02438)	(0.05918)
8	0.18932	0.23768	-0.06604	0.22199
	(0.15155)	(0.04001)	(0.04935)	(0.07877)
9	0.15644	0.10786	-0.02627	0.38885
	(0.15717)	(0.06074)	(0.01672)	(0.09361)
10	0.23824	0.12299	-0.02514	0.18349
	(0.17296)	(0.05347)	(0.01388)	(0.08043)
11	0.14566	0.14235	-0.06073	0.39217
	(0.12827)	(0.04226)	(0.03284)	(0.07328)
12	0.23265	0.14220	-0.09916	0.19678
	(0.18749)	(0.04651)	(0.11409)	(0.10208)
13	-0.13246	0.46330	-0.03062	0.27327
	(0.07008)	(0.08944)	(0.01255)	(0.06132)
14	-0.13713	0.57673	-0.02539	0.13082
	(0.07505)	(0.17613)	(0.01027)	(0.06539)
15	-0.13900	0.42712	-0.05820	0.31023
	(0.06915)	(0.07841)	(0.03245)	(0.05541)
16	-0.12884	0.52584	-0.06519	0.16507
	(0.07113)	(0.12638)	(0.04215)	(0.08026)
17	-0.13474	0.30266	-0.03622	0.36135
	(0.06729)	(0.04501)	(0.01525)	(0.06072)
18	-0.12961	0.30562	-0.03363	0.22267
	(0.07362)	(0.04738)	(0.01641)	(0.06984)
19	-0.13780	0.30028	-0.06582	0.38061
	(0.07264)	(0.04775)	(0.03025)	(0.05318)
20	-0.13087	0.30694	-0.05901	0.26852
	(0.07240)	(0.04581)	(0.02590)	(0.06631)
21	-0.13654	0.14787	-0.02908	0.45288
	(0.07333)	(0.06567)	(0.01601)	(0.08092)

Table 4.2(continued)

Portfolio**	NMP	DEPT	WAGE	INVT
22	-0.12749 (0.07303)	0.17543 (0.04944)	-0.02824 (0.01380)	0.24119 (0.09786)
23	-0.12801 (0.07100)	0.17280 (0.04877)	-0.07092 (0.03756)	0.46303 (0.06855)
24	-0.13277 (0.07466)	0.18789 (0.04637)	-0.06628 (0.04927)	0.30530 (0.08440)
25	-0.37920 (0.14715)	0.50255 (0.09426)	-0.02788 (0.01013)	0.26341 (0.08544)
26	-0.43460 (0.14467)	0.68449 (0.14778)	-0.02208 (0.00947)	0.07302 (0.05554)
27	-0.38331 (0.12461)	0.50144 (0.10011)	-0.06374 (0.03107)	0.27781 (0.07705)
28	-0.41337 (0.14265)	0.63346 (0.14906)	-0.07691 (0.04088)	0.08914 (0.08188)
29	-0.37077 (0.11081)	0.31410 (0.04807)	-0.03209 (0.01373)	0.37811 (0.07284)
30	-0.37526 (0.11575)	0.33235 (0.04810)	-0.03024 (0.01441)	0.20329 (0.08269)
31	-0.38457 (0.12545)	0.30902 (0.04061)	-0.06920 (0.03659)	0.42758 (0.08010)
32	-0.37693 (0.15889)	0.32675 (0.04449)	-0.06067 (0.02503)	0.27755 (0.07589)
33	-0.35238 (0.09407)	0.16728 (0.06128)	-0.02698 (0.01191)	0.48307 (0.09206)
34	-0.39986 (0.15745)	0.17178 (0.05993)	-0.02717 (0.01177)	0.25074 (0.11329)
35	-0.36755 (0.12701)	0.18817 (0.04974)	-0.06440 (0.03841)	0.51003 (0.11039)
36	-0.38804 (0.16868)	0.20089 (0.04905)	-0.05574 (0.02437)	0.32246 (0.07742)

* Standard deviations are in parentheses.

** Portfolios are ranked from (H,H,H,H) to (L,L,L,L) according to NMP, DEPT, WAGE, and INVT, respectively.

Table 4.3

Correlation Analysis

A. Correlation matrix for the first sample (27 portfolios, p = 1,...,27).

	LNMP	DEPT	SNMP	P
LNMP	1.0	-0.264[1]	0.258[1]	0.913[1]
DEPT		1.0	-0.241[1]	0.052[2]
SNMP			1.0	0.259[1]
P				1.0

B. Correlation matrix for the second sample (36 portfolios, P = 1,...,36).

	NMP	DEPT	WAGE	INVT	P
NMP	1.0	-0.348[2]	-0.024	-0.106	0.904[1]
DEPT		1.0	0.055	-0.600[1]	0.019
WAGE			1.0	-0.123	0.097
INVT				1.0	-0.243
P					1.0

[1] Significant at the 1% level.

[2] Significant at the 5% level.

The correlation between P and NMP is 0.904. This might indicate that the composition of portfolios is not as expected from high to low for the other three variables. The main problem with the second sample is that its size is relatively small.

An interesting result in table 4.3 is that LNMP, SNMP and NMP are negatively correlated with DEPT at the 1% or 5% significant level. This implies that firms with large depreciated assets tend to have higher debt. It is reasonable to expect capital intensive firms to borrow more as they are able to use their assets as collateral. Part A of table 4.3 shows that the correlation between LNMP and SNMP is 0.258 (significant at the 1% level). This indicates that firms with high debt tend also to have relatively high short term monetary liabilities.

The objective of the formation of portfolios was to construct portfolios so that, with respect to the nominal contracting variables, variance between portfolios was maximized while variance within portfolios was minimized. The ANOVA analysis provides such information. Table 4.4 presents the results of the ANOVA analysis for the two samples. The F tests for the equality of the means across portfolios of a variable are also included in table 4.4. The null hypothesis with every F test was that the means of the concerned variable are equal. A significant F-value would reject the equality of the means.

Table 4.4

ANOVA Analysis of Nominal Contracting Variables

A. Analysis of the first sample with the variables: LNMP, DEPT and SNMP.

	LNMP	%	DEPT	%	SNMP	%
Variance between portfolios	42.39	95.5	60.71	98.0	37.79	92.0
Variance within portfolios	1.98	4.5	1.25	2.0	2.95	8.0
Total Variance	44.37	100.0	61.96	100.0	36.74	100.0
F-Value	(1755.63)[1]		(3971.54)[1]		(939.4)[1]	

B. Analysis of the second sample with the variables: NMP, DEPT, WAGE and INVT.

	NMP	%	DEPT	%	WAGE	%	INVT	%
Variance between portfolios	138.02	90.3	63.95	92.5	1.17	48.3	31.93	84.2
Variance within portfolios	14.88	9.7	5.18	7.5	1.25	51.7	6.0	15.8
Total Variance	152.90	100.0	69.13	100.0	2.42	100.0	37.93	100.0
F-Value	(753.6)[1]		(1003.56)[1]		(76.14)[1]		(432.2)[1]	

[1] Significant at the 1% level.

Part A of table 4.4 shows that the percentage of the variances between portfolios for LNMP, DEPT and SNMP (in the first sample) are 95.5%, 98% and 92%, respectively. This indicates that the objective of the formation of portfolios was met in the first sample. The F-values for the equality of the means for each of the three variables were rejected at the 1% level. Part B of table 4.4 shows that the percentage of the variances between portfolios for NMP, DEPT, WAGE and INVT (in the second sample) are 90%, 92.5%, 48.3% and 84.2%, respectively. Except for WAGE, the variances within portfolios for the variables were as expected minimal. The F-values for the equality of the means of each of the four variables within portfolios were also rejected at the 1% level.

4.3 Maturity Effects Tests

The theory predicts that the longer the term of a nominal contract the larger the effect of unexpected inflation on common stock returns. In order to test for this effect, the study performs maturity effect tests. According to these tests, the coefficient of a longer term to maturity variable should be larger than the coefficient of a shorter term to maturity variable. That is, for the nominal contracting variables considered in models 4.1a and 4.1b, the following relations should hold, respectively.[5]

$$abs(a_1) > abs(a_2) > abs(a_3) \tag{4.2a}$$

and

$$abs(c_1) > abs(c_2) > abs(c_3) > abs(c_4) \tag{4.2b}$$

Each pair in each of the above relations has to be tested separately. For that reason, a one-tail maturity effect test was developed. The null hypothesis for the test was that the absolute value of the coefficient of the shorter term to maturity variable (α_2) is larger than or equal to the absolute value of the coefficient of the longer term to maturity variable (α_1). That is abs (α_2) - abs $(\alpha_1) \geq 0$. To perform the test, the difference of the two concerned variables (Y_2) was introduced as a new variable to replace the shorter term to maturity variable in the correponding multifactor model and the sum of the two variables (Y_1) to replace the longer term to maturity variable. If the hypothesis is true, then the coefficient of Y_2 should be significantly positive. In fact, the coefficient of Y_2 is equal to $1/2(\alpha_2 - \alpha_1)$. Since α_2 and α_1 are both expected to be negative, then the null hypothesis becomes $\alpha_2 - \alpha_1 \leq 0$ and the alternative hypothesis becomes $\alpha_2 - \alpha_1 > 0$. The resulted multifactor models were also estimated using the SUR techniques.

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[5]abs(.) represents the absolute value of the variable.

4.5 Summary and Conclusion

This chapter described the methodology employed in testing the nominal contracting effects. The seemingly unrelated regression (SUR) technique was used to estimate the nominal contracting effects. The advantage of using the SUR technique was to produce more efficient estimates by exploiting information about the error correlation structure. The residuals in the operational model were expected to the cross-sectionally correlated because of omitted common factors.

Equally weighted and updated portfolios were formed. The objectives of the formation of portfolios were to reduce the nonstationary bias of the betas and to decrease the number of time-series regression equations in order to meet the requirement of the SUR technique. The portfolios were formed in such a way that they had the most dispersion among their nominal contracting effects. This implied more powerful tests for the nominal contracting hypothesis.

The study was carried out in two parts. First, a sample was selected based on the availability of data for only three nominal contracting variables: the short net monetary position variable (SNMP), the long net monetary position variable (LNMP), and the depreciation tax effect variable (DEPT). The sample contained 59,397 observations. Twenty-seven portfolios were formed according to LNMP, DEPT and SNMP, respectively. For the second part of the study, a subsample (the second sample) of 19,573 observations was selected. It was based on all the nominal contracting variables considered in this study. In the subsample, 36 portfolios were formed. The first sample had three times more observations than the subsample and it is comparable to other similar studies.

The ANOVA analysis for the portfolios properties showed that in the first sample the dispersion among portfolios for each variable was as expected maximal. In the second sample, the dispersions among portfolios for the three variables: NMP, DEPT, and INVT were maximum. The dispersion among portfolios for the wage contract variable was not maximum. This might reduce the significance of the tests for the wage contract variable.

In further support for the nominal contracting hypothesis, this chapter ended by describing the maturity effect tests. According to the maturity effects tests, the coefficient of a longer term to maturity variable is expected to be larger than the coefficient of a shorter term to maturity variable. None of the previous studies have performed tests for the maturity effects, because the results of those studies were in general not consistent with the nominal contracting hypothesis.

CHAPTER 5

Empirical Results

The previous two chapters described the methodology and data used in testing the proposed nominal contracting effects. This chapter, which is divided into four sections, presents the empirical results. The first section examines the significance of the factors in the proposed multifactor model. The second section presents the empirical results of the nominal contracting effects. The third section presents the results of the maturity effect tests. The final section summarizes and concludes the chapter.

5.1 Tests for the Preliminary Multifactor Model

An important question prior to all nominal contracting effects tests is whether the betas in the preliminary multifactor models are significant in explaining common stock returns. In order to estimate the betas, the following multifactor model was assumed:

$$R_{pt} = \beta_0 + \beta_{mp}\,\delta_{mt} + \beta_{ep}\,\delta_{et} + \beta_{up}\,\delta_{ut} + u_{pt} \qquad (5.1)$$

Model 5.1 is similar to model 3.1 except that the items are defined for portfolios instead of individual securities.

Since the residuals of the model are expected to be correlated for the same reasons cited above, the SUR technique was used also for the analysis. For the model to be valid, β_{mp}, β_{ep} and β_{up} should be significantly different from zero.

Tables 5.1 and 5.2 summarize the results of the SUR analysis of multifactor model 5.1 for the first and second models, respectively. They contain the estimates and the standard deviations of the market beta, the expected inflation beta and the unexpected inflation beta, respectively. Table 5.3 presents the correlation analysis for the market beta, the unexpected inflation beta and the dummy variable p which is associated with the number of portfolios from high to low according to their nominal contracting variables for the two models.

Tables 5.1 and 5.2 show that the market factor was significantly different from zero at the 1% level with all the portfolios. Table 5.1 shows that the market betas ranged from a low of 0.77 to a high of 1.39. Portfolios with low nominal contracting positions had on average market betas less than one. Eight out of the first nine portfolios had market betas less than one. On the other hand, portfolios with high nominal contracting positions had betas greater than one. All of the last nine portfolios had market betas greater than one. The correlation between P and the market beta (part A table 5.3) is 0.71.

Table 5.1

Multifactor Model SUR Results[1]
(27 Portfolios)

Portfolio	Market Beta	Expected Inflation Beta	Unexpected Inflation Beta
1	0.8089*	-0.1979*	-0.2101*
	(0.0340)	(0.0353)	(0.0409)
2	0.7717*	-0.2307*	-0.2588*
	(0.0325)	(0.0337)	(0.0392)
3	0.7929*	-0.2108*	-0.2117*
	(0.0296)	(0.0307)	(0.0356)
4	0.8395*	-0.1718*	-0.2042*
	(0.0415)	(0.0431)	(0.0501)
5	0.8891*	-0.1167*	-0.1355*
	(0.0317)	(0.0329)	(0.0382)
6	0.9900*	-0.0214	-0.0217
	(0.0337)	(0.0350)	(0.0407)
7	0.9361*	-0.0697	-0.0768
	(0.0427)	(0.0444)	(0.0515)
8	0.9891*	-0.0245	-0.0200
	(0.0436)	(0.0453)	(0.0526)
9	1.1568*	0.1272*	0.1446*
	(0.0458)	(0.0476)	(0.0553)
10	0.7706*	-0.2387*	-0.2370*
	(0.0352)	(0.0365)	(0.0425)
11	0.7748*	-0.2250*	-0.2275*
	(0.0318)	(0.0330)	(0.0384)
12	0.7975*	-0.1945*	-0.1883*
	(0.0301)	(0.0312)	(0.0363)
13	0.8819*	-0.1202*	-0.1502*
	(0.0315)	(0.0327)	(0.0380)
14	0.8745*	-0.1284*	-0.1471*
	(0.0350)	(0.0364)	(0.0422)
15	0.9240*	-0.0895*	-0.0790**
	(0.0304)	(0.0316)	(0.0367)
16	1.0055*	-0.0102	-0.0230
	(0.0361)	(0.0375)	(0.0435)
17	0.9657*	-0.0386	-0.0360
	(0.0366)	(0.0380)	(0.0441)
18	1.1031*	0.0760***	-0.1155*
	(0.0388)	(0.0402)	(0.0467)
19	0.8763*	-0.1104*	-0.1376*
	(0.0346)	(0.0359)	(0.0417)
20	0.8868*	-0.1198*	-0.1030*
	(0.0378)	(0.0393)	(0.0456)
21	1.0698*	0.0658*	-0.0668
	(0.0459)	(0.0476)	(0.0553)

Table 5.1(continued)

Portfolio	Market Beta	Expected Inflation Beta	Unexpected Inflation Beta
22	0.9870*	-0.0351	-0.0316
	(0.0417)	(0.0433)	(0.0503)
23	1.0484*	0.0446	0.0650
	(0.0424)	(0.0440)	(0.0511)
24	1.1521*	0.1220*	0.1573*
	(0.0354)	(0.0367)	(0.0427)
25	1.2426*	0.2364*	0.2453*
	(0.0408)	(0.0423)	(0.0492)
26	1.2639*	0.2459*	0.2570*
	(0.0394)	(0.0409)	(0.0475)
27	1.3915*	0.3491*	0.4200*
	(0.0544)	(0.0565)	(0.0656)

[1] Standard deviations are in parentheses.

* Significant at the 1% level.
** Significant at the 5% level.
*** Significant at the 10% level.

Table 5.2

Multifactor Model SUR Results[1]
(36 Portfolios)

Portfolio	Market Beta	Expected Inflation Beta	Unexpected Inflation Beta
1	0.8300*	-0.1711*	-0.1954*
	(0.0580)	(0.0602)	(0.0696)
2	0.8637*	-0.1471**	-0.1674**
	(0.0694)	(0.0720)	(0.0836)
3	0.9361*	-0.0471	-0.1000
	(0.0638)	(0.0663)	(0.7698)
4	0.9545*	-0.0441	-0.1155
	(0.0760)	(0.0789)	(0.0916)
5	0.8792*	-0.1391**	-0.1370**
	(0.0566)	(0.0587)	(0.0682)
6	0.9441*	-0.0686	-0.0838
	(0.0666)	(0.0691)	(0.0804)
7	0.9753*	-0.0217	-0.0541
	(0.0643)	(0.0668)	(0.0775)
8	1.1020*	0.0897	0.0975
	(0.0822)	(0.0854)	(0.0992)
9	1.1911*	0.1660**	0.1695***
	(0.0724)	(0.0751)	(0.0873)
10	1.1174*	0.0934	0.1209
	(0.0635)	(0.0659)	(0.0770)
11	0.9392*	-0.0935	0.0579
	(0.0832)	(0.0863)	(0.1003)
12	1.1272*	0.1065	0.1204
	(0.0745)	(0.0774)	(0.0899)
13	0.7882*	-0.2177*	-0.2592*
	(0.0640)	(0.0665)	(0.0772)
14	0.8848*	-0.0907	-0.1312**
	(0.0672)	(0.0698)	(0.0810)
15	0.9592*	-0.0521	-0.0634
	(0.0505)	(0.0524)	(0.0609)
16	1.2286*	0.2306*	0.2728*
	(0.0736)	(0.0764)	(0.0887)
17	1.0140*	0.0107	0.0011
	(0.0672)	(0.0698)	(0.0810)
18	0.9867*	-0.0059	-0.0258
	(0.0630)	(0.0654)	(0.0760)
19	0.9088*	-0.0728	-0.1481**
	(0.0596)	(0.0619)	(0.0719)
20	1.0579*	0.0555	0.0386
	(0.0719)	(0.0746)	(0.0867)
21	1.2052*	0.1812**	0.1592***
	(0.0816)	(0.0847)	(0.0984)

Table 5.2(continued)

Portfolio	Market Beta	Expected Inflation Beta	Unexpected Inflation Beta
22	1.2880*	0.3166*	0.3075*
	(0.0818)	(0.0850)	(0.0987)
23	1.0726*	0.0043	0.0537
	(0.0698)	(0.0724)	(0.0841)
24	1.2267*	0.1998**	0.2233**
	(0.0759)	(0.0788)	(0.0915)
25	1.1228*	0.1133	0.1793**
	(0.0858)	(0.0890)	(0.1034)
26	0.9743*	-0.0060	0.0037
	(0.0657)	(0.0682)	(0.0792)
27	1.0059*	0.0099	0.0153
	(0.0874)	(0.0907)	(0.1054)
28	1.1462*	0.1275	0.0967
	(0.0814)	(0.0845)	(0.0982)
29	1.1923*	0.2144*	0.2064**
	(0.0817)	(0.0848)	(0.0985)
30	1.2403*	0.2184*	0.2643*
	(0.0776)	(0.0805)	(0.0935)
31	1.1149*	0.0852	0.0349
	(0.0687)	(0.0713)	(0.0829)
32	1.3010*	0.2560**	0.3167*
	(0.0963)	(0.1000)	(0.1161)
33	1.4326*	0.3767*	0.4656*
	(0.0841)	(0.0873)	(0.1014)
34	1.5059*	0.4706*	0.5359*
	(0.0811)	(0.0842)	(0.0978)
35	1.1179*	0.0926	0.1166
	(0.0821)	(0.0852)	(0.0990)
36	1.4258*	0.4023*	0.3564*
	(0.0783)	(0.0812)	(0.0943)

1 Standard deviations are in parentheses.

* Significant at the 1% level.
** Significant at the 5% level.
*** Significant at the 10% level.

Table 5.3

Correlation Analysis of the Multifactor Model Betas

A. Analysis of the first sample (27 portfolios):

	P	β_m	β_u
P	1	0.71	0.73
β_m		1	0.99
β_u			1

B. Analysis of the second sample (36 portfolios):

	P	β_m	β_u
P	1	0.70	0.69
β_m		1	0.98
β_u			1

This shows that the order of the market betas is not strictly from high to low. This result is expected since the order of the nominal contracting variables (as shown in table 4.3) is roughly from high to low. Table 5.2 shows similar results. The market betas ranged from a low 0.83 to a high 1.50. Nine out of the first twelve portfolios had market betas less than one. Eleven out of the top twelve portfolios had market betas greater than one. The correlation between P and the market betas (part B table 5.3) is 0.70.

These results are consistent with the capital structure theory, which predicts that levered firms (firms with high net debtor positions) have market betas larger than the market betas of unlevered firms (firms with low net debtor positions or with net creditor positions). The results of tables 5.1 and 5.2 show that portfolios with low nominal contracting positions had market betas which are lower than those of portfolios with high nominal contracting positions. Those results are to a certain degree similar to the results of Hess and Bicksher (as reported by Rozeff (1977)). The results of Hess and Bicksher showed that the average of the (traditional) market betas of net creditor firms is 0.72 and that of net debtor firms is 1.01.

Of particular importance is the analysis of the unexpected inflation betas. Table 5.1 shows that 19 out of

27 portfolios' unexpected inflation betas were significantly different from zero: six were significantly positive and 13 were significantly negative. The beta values ranged from -0.26 to +0.42. Table 5.2 shows that 16 out of 36 portfolios' unexpected inflation betas were significantly positive and five were significantly negative. The beta values ranged from -0.20 to +0.53. FRS (1983) have also found similar results. The unexpected inflation betas were ranged from a low of -1.65 to a high of 1.3. FRS did not include the market factor in their model. Bernard (1984) found that most of the unexpected inflation betas were negative. He followed an industry grouping portfolios approach.

Tables 5.1 and 5.2 also show that portfolios with low net debtor positions and high depreciation tax positions tend to have negative values of unexpected inflation betas and portfolios with high net debtor positions and low depreciation tax positions tend to have positive values of unexpected inflation betas. Table 5.1 shows that eight out of the top nine portfolios had negative unexpected inflation betas (five were significantly negative). Six out of the bottom nine portfolios had positive unexpected inflation betas (four were significantly positive). As shown in table 5.3, the correlation between p and the unexpected inflation betas is 0.73. Table 5.2 shows that seven out of the top twelve portfolios had negative unexpected inflation betas (three were significantly negative). The twelve bottom portfolios had positive unexpected inflation betas. Eight of them were significantly positive. Again, table 5.3 shows that the correlations between p and the unexpected inflation betas is 0.69.

It can be noticed from the above analysis that portfolios which had positive unexpected inflation betas had market betas larger than one and portfolios which had negative unexpected inflation betas had market betas less than one. Table 5.3 shows that the correlations between the market betas and the unexpected inflation betas are significantly positive for the two models. The correlations for the two models are 0.99 and 0.98, respectively. These results are consistent with the nominal contracting hypothesis as well as the capital structure theory. Although these results tend to support nominal contracting theory, more can be learned from the cross sectional results of the next section.

Tables 5.1 and 5.2 show also that the expected inflation betas were significant most of the time. As mentioned above, the effect of expected inflation is mysterious. However, it is similar to that found by FRS (1983) and others.

5.2 Estimates of the Nominal Contracting Effects

In this section, the proposed extended multifactor model and the model proposed by FRS (1983) were analyzed with two different sets of the nominal contracting variables. The first set included the variables: LNMP, DEPT and SNMP. The second set included the variables: NMP, DEPT, WAGE and INVT.

For each of the above models, the SUR analysis was run twice, once with and once without imposing the restriction that the nominal contracting coefficients be equal across portfolios. First, the coefficients of the nominal contracting variables were estimated. Second, the F-tests for the equality of the nominal contracting coefficients were computed. The null hypothesis with every F test was that the coefficients of the concerned variables are equal across portfolios. A significant F-value would reject the equality of the coefficients of the variables. Tables 5.4 and 5.5 contain the restricted coefficients of the different models and F test values for the equality of the coefficients.

In general, a_0 (the constant term) in the models considered in table 5.4 can vary across portfolios. Allowing it to do so is equivalent to including a dummy variable for each portfolio in the regression. The remaining variables only have explanatory power in as much as they contain additional information not included in these dummies. As the analysis of variance contained in table 4.4 demonstrates, after removing the variance accounted for by portfolio membership (between group

Table 5.4
SUR Tests of the Nominal Contracting Effects *
(27 portfolios)
Results from the analysis of the two following models:

(1) the FRS model:

$$R_{pt} = \beta_0 + \beta_{ep}\,\delta_{et} + (a_0 + a_1\,LNMP_p + a_2\,DEPT_p + a_3\,SNMP_p + e_p)\delta_{ut} + e'_{pt} \qquad (5.1a)$$

(2) the multifactor model:

$$R_{pt} = \beta_0 + \beta_{mp}\,\delta_{mt} + \beta_{ep}\,\delta_{et} + (a_0 + a_1\,LNMP_p + a_2\,DEPT_p + a_3\,SNMP_p + e_p)\delta_{ut} + e'_{pt} \qquad (5.1b)$$

a_0	a_1	a_2	a_3	F-statistic $a_{0p}=a_0, a_{1p}=a_1, a_{2p}=a_2, a_{3p}=a_3$	F-statistic $a_{1p}=a_1, a_{2p}=a_2, a_{3p}=a_3$
model 1: the FRS model (a_0 varies across portfolios).					
n.a.[4]	0.133	-0.0331	0.154	2.23[1]	2.44[1]
(n.a.)	(0.138)	(0.120)	(0.104)		
(2.19[1])	(3.17[1])	(1.71[2])	(3.36[1])		
model 2: the multifactor model (a_0 varies across portfolios).					
n.a.	-0.105	-0.152	-0.184[2]	2.38[1]	2.01[1]
(n.a.)	(0.110)	(0.096)	(0.081)		
(1.90[1])	(1.74[2])	(1.96[1])	(1.44[3])		
model 3: the FRS model (a_0 is constant).					
-1.10[1]	0.013	0.053[3]	-0.037	n.a.	2.21[1]
(0.0305)	(0.032)	(0.030)	(0.023)		
(n.a.)	(2.99[1])	(2.53[1])	(2.89[1])		
model 4: the multifactor model (a_0 is constant).[5]					
0.009	-0.488[1]	-0.321[1]	-0.228[1]	n.a.	2.51[1]
(0.025)	(0.060)	(0.058)	(0.044)		
(n.a.)	(2.03[1])	(2.74[1])	(1.58[1])		
model 5: the multifactor model (a_0 is forced to be zero).					
0.0	-0.495[1]	-0.309[1]	-0.219[1]	n.a.	2.58[1]
(n.a.)	(0.060)	(0.040)	(0.042)		
(n.a.)	(2.08[1])	(2.84[1])	(1.58[2])		

* Standard deviations and the F-tests for the equality of the corresponding coefficients are in parentheses below the coefficient estimates, respectively. For instance, the F-test for the equality of the coefficient of the unexpected inflation variable (a_0) is the test of $a_{0p}=a_0$ ($p=1,\ldots,36$).
[1] significant at the 1% level.
[2] significant at the 5% level.
[3] significant at the 10% level.
[4] n.a. =not applicable
[5] The Equally Weighted Index for NYSE stocks was used in the above model. When the Value Weighted Index for NYSE stocks was used, a_0, a_2, and a_1 were still negative. a_0 and a_1 were significant at the 10% level. a_2 was significant at the 1% level.

Table 5.5
SUR Tests of the Nominal Contracting Effects *
(36-a portfolios)
Results from the analysis of the two following models:

(1) the FRS model:

$$R_{pt} = \beta_0 + \beta_{ep}\,\delta_{et} + (c_0 + c_1\,NMP_p + c_2\,DEPT_p + c_3\,WAGE_p + c_4\,INVT_p + e_p)\delta_{ut} + e'_{pt} \quad (5.2a)$$

(2) the multifactor model:

$$R_{pt} = \beta_0 + \beta_{mp}\,\delta_{mt} + \beta_{ep}\,\delta_{et} + (c_0 + c_1\,NMP_p + c_2\,DEPT_p + c_3\,WAGE_p + c_4\,INVT_p + e_p)\delta_{ut} + e'_{pt} \quad (5.2b)$$

c_0	c_1	c_2	c_3	c_4	F-statistic $c_{0p}=c_0, c_{1p}=c_1, c_{2p}=c_2, c_{3p}=c_3$	F-statistic $c_{1p}=c_1, c_{2p}=c_2, c_{3p}=c_3$
model 6: the FRS model (c_0 varies across portfolios).						
n.a.[4]	0.068	-0.05	-0.09	-0.34[1]	3.02[1]	3.22[1]
(n.a.)	(0.080)	(0.090)	(0.32)	(0.09)		
(2.13[1])	(3.28[1])	(2.34[1])	(2.90[1])	(2.99)		
model 7: the multifactor model (c_0 varies across portfolios).						
n.a.	-0.175[1]	-0.088	-0.03	-0.22[2]	3.40[1]	2.89[1]
(n.a.)	(0.06)	(0.09)	(0.24)	(0.09)		
(2.12[1])	(2.80[1])	(2.44[1])	(3.12[1])	(2.58[1])		
model 8: the FRS model (c_0 is constant).						
-1.044[1]	0.025	0.03	0.01	-0.13[1]	n.a.	3.20[1]
(0.044)	(0.023)	(0.04)	(0.173)	(0.04)		
(n.a.)	(3.60[1])	(3.43[1])	(3.24[1])	(3.53[1])		
model 9: the multifactor model (c_0 is constant).[5]						
0.20[1]	-0.35[1]	-0.48[1]	0.11	-0.42[1]	n.a.	3.66[1]
(0.04)	(0.04)	(0.07)	(0.23)	(0.07)		
(n.a.)	(3.23[1])	(3.68[1])	(3.31[1])	(3.36[1])		
model 10: the multifactor model (c_0 is forced to be zero).						
0.0	-0.31[1]	-0.26[1]	-0.03	-0.16[1]	n.a.	3.83[1]
(n.a.)	(0.04)	(0.04)	(0.23)	(0.05)		
(n.a.)	(2.96[1])	(3.73[1])	(3.32[1])	(3.50[1])		

* Standard deviations and F-tests are in parentheses.

[1] significant at the 1% level.
[2] significant at the 5% level.
[3] significant at the 10% level.
[4] n.a. =not applicable
[5] The Equally Weighted Index for NYSE stocks was used in the above model. When the Value Weighted Index for NYSE stocks was used, c_0 and c_3 were negative and significant at the levels 10% and 5%, respectively. c_2 and c_4 were not significant.

variance) very little remains. Allowing a_0 to vary thus creates a multicollinearity problem between the dummy variables and the remaining nominal contracting variables. Note that this correlation between the dummy variables and the independent variables is expected because of the way the portfolios were formed according to their nominal contracting variables. The same analysis is true with c_0 in the models considered in table 5.5. Tables 5.4 and 5.5 present the results of the above models in two cases. In the first case, a_0 or c_0 was allowed to vary across portfolios, and in the second case, each was restricted to a constant value across portfolios. This helped to compare the results with FRS (1983). FRS considered only the case where the constant term is allowed to vary across portfolios.

Table 5.4 presents the results of the FRS models and the multifactor models with the variables: LNMP, DEPT and SNMP. The analysis of model 1 (table 5.4), where a_0 is allowed to vary across portfolios in the FRS model, shows that none of the coefficients is significant. The coefficient of the variable DEPT is negative but still not significant. The FRS (1983) results for the period 1964-79 showed that: (a) the long net monetary position variable was significant but had the opposite predicted sign, (b) the depreciation tax variable had the right predicted sign but was not significant, and (c) the short net monetary position was the only one to be found significant with the right predicted sign.[1] FRS (1983) concluded their study that "there is no strong support for the nominal contracting hypothesis."

When the market factor was included (model 2), the results show that the coefficients of LNMP and DEPT are negative but not significant. The coefficient of SNMP is negative and significant at the 5% level. Although the results obtained from model 2 are relatively stronger than those obtained from model 1, they might not be as informative as they would be in the absence of the multicollinearity discussed above.

When a_0 is constrained to a constant value in the FRS model (model 3), the coefficnet of DEPT becomes significant with the opposite predicted sign. The coefficient of SNMP is negative but not significant. Notice that a_0 is significantly different from zero indicating the presence of an unexplained negative effect of unexpected inflation. As explained above, the exclusion of an important factor such as the market factor might have biased the coefficient estimates.

When a_0 is restricted to a constant value in the multifactor model (model 4), the coefficients of all the variables, LNMP, DEPT and SNMP, become negative and

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[1]FRS (1983) employed nominal returns intead of real returns.

significant at the 1% level. This may be the strongest result to date in support for the nominal contracting hypothesis. Notice that a_0 in model 4 is not significantly different from zero. For this reason, the results from model 5 show also that the coefficients of all the variables are significant and negative. The difference between model 4 and model 5 is that a_0 is forced to be zero in model 5.

Most of the F-values for the equality of the coefficients of the variables in table 5.4 are significantly different from zero at the 1% level. This implies that the coefficients of the variables are not the same across portfolios. The coefficients of the variables can then be interpreted as measuring the average effect of the nominal contracting effects of a firm on its unexpected inflation risk. Such results are expected since the duration terms of the nominal contracting variables were assumed to be the same across firms.

Table 5.5 presents the results of the FRS model and the multifactor model including the second set of the variables (NMP, DEPT, WAGE and INVT). The analysis of model 6 (the FRS model when c_0 is constant) and model 8 (the FRS model when c_0 varies across portfolios) shows that the coefficient of INVT is the only significant one. INVT also has the predicted sign. The analysis of multifactor model 7 (when c_0 varies across portfolios) shows that all the coefficients are negative but only the coefficients of NMP and INVT are significant at the 1% level. When c_0 is restricted to a constant value in multifactor models 9 and 10, the coefficients of NMP, DEPT and INVT become negative and significant at the 1% level. The three models (7, 9 and 10) show some consistency in their results regardless of the assumption made concerning the constant term c_0. Notice that c_0 in model 9 is significantly different from zero. Nevertheless, these results still present strong support for the nominal contracting hypothesis. Table 5.5 shows that all the F-tests were also significant at the 1% level. That is, the coefficients of the variables are not the same across portfolios.

There are two possible explanations for the statistical insignificance of the wage contract variable. First, the number of employees used in estimating the variable is not a good proxy for the variable. Second, the wage contract variable (which is a part of accounts payable) is highly correlated with the short-term liabilities included in the computation of NMP. Its effect may be captured by NMP. When the analysis (with 36 portfolios) was repeated with the four nominal contracting variables--LNMP, DEPT, SNMP and INVT-SNMP was found to be not significant. This might indicate that SNMP is a close substitute for the wage contract variable.

Table 5.6 presents the results of the analysis with the four nominal contracting variables: LNMP, DEPT, SNMP

Table 5.6
SUR Tests of the Nominal Contracting Effects *
(36-b portfolios)
Results from the analysis of the two following models:

(1) the FRS model:

$$R_{pt} = \beta_0 + \beta_{ep}\,\delta_{et} + (b_0 + b_1\,LNMP_p + b_2\,DEPT_p + b_3\,SNMP_p + b_4\,INVT_p + e_p)\delta_{ut} + e'_{pt} \quad (5.3a)$$

(2) the multifactor model:

$$R_{pt} = \beta_0 + \beta_{mp}\,\delta_{mt} + \beta_{ep}\,\delta_{et} + (b_0 + b_1\,LNMP_p + b_2\,DEPT_p + b_3\,SNMP_p + b_4\,INVT_p + e_p)\delta_{ut} + e'_{pt} \quad (5.3b)$$

b_0	b_1	b_2	b_3	b_4	F-statistic $b_{0p}=b_0, b_{1p}=b_1, b_{2p}=b_2, b_{3p}=b_3$	F-statistic $b_{1p}=b_1, b_{2p}=b_2, b_{3p}=b_3$
model 11: the FRS model (b_0 varies across portfolios).						
n.a.[4]	0.118	-0.268[2]	-0.138[3]	-0.241[2]	3.03[1]	3.41[1]
(n.a.)	(0.102)	(0.104)	(0.0734)	(0.095)		
(2.19[1])	(3.25[1])	(3.30[1])	(1.91[1])	(3.30[1])		
model 12: the multifactor model (b_0 varies across portfolios).						
n.a.	0.118[2]	-0.197[2]	0.055	-0.074	3.31[1]	2.97[1]
(n.a.)	(0.083)	(0.091)	(0.065)	(0.087)		
(1.42[3])	(2.89[1])	(1.82[1])	(1.45[2])	(2.68[1])		
model 13: the FRS model (b_0 is constant).						
-1.084[1]	0.024	0.007	-0.003	-0.120[2]	n.a.	3.19[1]
(0.044)	(0.031)	(0.041)	(0.039)	(0.053)		
(n.a.)	(3.05[1])	(3.99[1])	(3.88[1])	(4.19[1])		
model 14: the multifactor model (b_0 is constant).[5]						
0.14[1]	-0.19[1]	-0.27[1]	-0.018	-0.18[2]	n.a.	3.77[1]
(0.045)	(0.056)	(0.063)	(0.057)	(0.074)		
(n.a.)	(2.81[1])	(1.78[1])	(3.64[1])	(3.29[1])		
model 15: the multifactor model (b_0 is forced to be zero).						
0.0	-0.25[1]	-0.13[1]	0.009	-0.095[2]	n.a.	3.72[1]
(n.a.)	(0.05)	(0.04)	(0.040)	(0.046)		
(n.a.)	(2.79[1])	(1.83[1])	(3.77[1])	(3.46[1])		

* Standard deviations and F-tests are in parentheses.

[1] significant at the 1% level.
[2] significant at the 5% level.
[3] significant at the 10% level.
[4] n.a. =not applicable
[5] The Equally Weighted Index for NYSE stocks was used in the above model. When the Value Weighted Index for NYSE stocks was used, b_4 was negative and significant at the level 10%, b_2 was negative but not significant, and b_1 and b_3 were positive but not significant.

and INVT. Again the best results in support of the nominal contracting hypothesis were obtained through the analysis of the multifactor models. Model 14, which considers the multifactor model with the constant term being restricted to a constant, shows that the coefficients of LNMP, DEPT and INVT are significant and have the predicted sign. The coefficient of SNMP is negative but not significant. Model 15, which considers the multifactor model with the constant term being forced to a zero, shows also that the coefficients of LNMP, DEPT and INVT are significant and have the predicted sign. The coefficient of SNMP is positive but not significant.

A surprising result is that the coefficient of INVT was found to be significant and had the predicted sign in all but one of the ten models considered in tables 5.5 and 5.6. The results for INVT were consistent whether the market factor was included or not or whether an assumption was made on the constant term or not. In tables 5.4, 5.5 and 5.6 strong results were obtained for LNMP and DEPT when the market factor was included in the model and when the constant term (a_0, b_0 or c_0) was restricted to a constant or was forced to be a zero. That is, in models 4, 5, 9, 10, 14 and 15, the coefficients of LNMP and DEPT were found to be negative as predicted and significant at the 1% level. In general, all the FRS models in Tables 5.4, 5.5 and 5.6 were improved when the market factor was included.

The coefficients of the nominal contracting variables became more significant with the appropriate predicted signs.

The control for the pure portfolio effects did not improve the results of the FRS models. Models 3, 8 and 13 (in which constant terms are constant) and models 1, 6 and 11 (in which the constant terms vary across portfolios) all showed weak support for the nominal contracting hypothesis. Notice that the constant terms in the former three models are significantly different from zero, indicating the capture of missing factors. On the other hand, control of the pure portfolio effects of the extended multifactor models did in fact provide stronger support for the nominal contracting hypothesis.

As mentioned above, the Equally Weighted Index for NYSE stocks was used as a proxy for the market portfolio in all the multifactor models considered above. The reason for that was the portfolios used in this study were also formed on an equally weighted basis. When the Value Weighted Index for NYSE stocks was used, the results were less supportive for the nominal contracting hypothesis.

5.3 Results for the Maturity Effect Tests

More stringent tests for the nominal contracting hypothesis are provided by testing the maturity effects of the nominal contracting variables. Table 5.7 presents the results of the maturity effect tests of the two multifactor models considered above. The coefficients for the maturity tests are reported for each pair of related variables in equations 4.2a and 4.2b . To be consistent with the theory, the coefficients of the maturity tests should be significantly positive.

Part A in table 5.7 presents the results of the maturity tests of the multifactor model with the variables LNMP, DEPT and SNMP. When a_0 is allowed to vary, none of the maturity effect tests was found to be consistent with the theory. The coefficients of the three pairs of the variables were found to be negative and not significant. When a_0 is restricted to a constant value, the coefficients of the two pairs SNMP-LNMP and DEPT-LNMP were found to be positive and significant at the 1% level and 5% level, respectively. The coefficient of the third pair, SNMP-DEPT, was found to be positive but not significant.

Part B of table 5.7 presents the coefficients of the maturity effect tests of the multifactor model with the variables NMP, DEPT, WAGE and INVT. When the constant term in the model, c_0, is allowed to vary, the coefficients of all six pairs were found to be not significant. Four of them were positive. When c_0 is restricted to a constant value, the coefficients of the three pairs WAGE-DEPT, WAGE-INVT and WAGE-LNMP were found to be positive and significant at the 5% level. The coefficients of the other three pairs were not consistent with the theory. Because

Table 5.7

Maturity Tests Results*

A. The multifactor models with the variables: LNMP, DEPT and SNMP.

Variables	a_o Varies	a_o Constant
SNMP-LNMP	-0.039 (0.072)	0.13[1] (0.035)
SNMP-DEPT	-0.016 (0.055)	0.047 (0.032)
DEPT-LNMP	-0.023 (0.075)	0.084[2] (0.032)

B. The multifactor models with the variables: NMP, DEPT, WAGE and INVT.

Variables	a_o Varies	a_o Constant
WAGE-NMP	0.071 (0.124)	0.231[2] (0.115)
WAGE-DEPT	0.028 (0.124)	0.295[2] (0.115)
WAGE-INVT	0.092 (0.123)	0.263[2] (0.116)
INVT-NMP	-0.020 (0.047)	-0.033 (0.036)
INVT-DEPT	-0.064 (0.049)	0.031 (0.037)
DEPT-NMP	0.043 (0.047)	-0.064[2] (0.031)

* Standard deviations are in parentheses.

[1] Significant at the 1% level.

[2] Significant at the 5% level.

the wage contract variable was found to be not significant in the first place, the results of the maturity effect tests of the second multifactor model provide less support for the nominal contracting hypothesis. Given the size and the properties of the second sample, those results were not unexpected.

5.4 Summary and Conclusion

The purpose of this chapter was to present the results of the proposed multifactor model tests, the nominal contracting effects tests and the maturity effect tests. The results of the proposed multifactor model tests showed that the three factors are significantly different from zero. As expected, portfolios with high net debtor positions and low depreciation tax positions had positive unexpected inflation betas and market betas which were higher than one. On the other hand, portfolios with low net debtor positions (or net creditor positions) and high depreciation tax positions had negative unexpected inflation betas and market betas which were less than one. These results are consistent with the nominal contracting hypothesis as well as the capital structure theory. The captial structure theory states that levered firms tend to have high market betas and unlevered firms tend to have low market betas.

The results of the nominal contracting effects tests showed that the estimates of the coefficients, except for the wage contract variable, are consistent with the nominal contracting hypothesis. The coefficients were significantly different from zero and had the predicted signs. In most cases, the F tests for the equality of the coefficients rejected the null hypotheses that the coefficients are equal across portfolios. This implies that the coefficients measure the average effect of the nominal contracting variables of a firm on its unexpected inflation risk.

The wage contract variable was found to beinsignificant because it was highly correlated with the short monetary position variable. Actually, it is related to the wage payable account, which is a part of the short net monetary liabilities. The short net monetary position variable was found to be a close substitute of the wage contract variable. In general, the results of the maturity effects tests tend to support the nominal contracting hypothesis.

CHAPTER 6

Concluding Remarks

The final chapter includes three sections. The conclusions of the study and its implications are considered in the first section. The second section discusses the limitations of the study. The final section includes suggestions for future research.

6.1 Conclusions and Implications

In contrast to most previous work, this study provided strong support for the nominal contracting hypothesis. This may be attributed to changes in model specifications and improvements in methodology. Among those are: the adequate control for the market factor, the use of real returns, the treatment of unexpected inflation as a continuous and systematic factor and the removal of pure portfolio effects.

In one part of the study, the three factors of the proposed multifactor model were analyzed. They were found to be significantly different from zero. The market factor was always significant at the 1% level. Expected and unexpected inflation factors were significant most of the time. As expected, portfolios with high levels of nominal liabilities and low levels of nominal assets had positive unexpected inflation betas and market betas larger than one. Portfolios with low levels of nominal liabilities and high levels of nominal assets had negative unexpected inflation betas and market betas smaller than one. The results are consistent with the nominal contracting hypothesis and the capital structure theory.

The results of the nominal contracting effects can be summarized as follows. Strong results were obtained for the long net monetary position effect, the depreciation tax effect and the inventory tax effect. Those effects were negative as predicted and significant at the one percent level. The results obtained for the short net monetary position effect were mixed and sensitive to the sample size. The short net monetary position effect was negative and significant at the one percent level in the main sample of 59,397 observations and was not significant in the subsample of 19,397 observations. The wage contract variable was not significant. The results showed that the short net monetary position variable is a close substitute for the wage contract variable. The wage contract variable is highly correlated with the wage payable account which is part of the composition of the short net monetary position variable. The lack of support for the short net monetary position and the wage contract variable in the subsample is not surprising given the properties of the portfolios constructed from the subsample.

The results also suggest that the nominal contracting effects are not the same across portfolios. These results were not unexpected, since only a subset of the nominal contracting effects was considered and since it was implicitly assumed that the nominal contracting variables have the same duration for all firms. This implies that the coefficients of the nominal contracting variables reflect the average unexpected inflation effect on common stock returns.

In general, the results of the maturity effect tests tend to support the nominal contracting hypothesis. This indicates that the unexpected inflation effect was found to have a larger impact on the variables with longer term to maturity than the variables with shorter term to maturity. These results may provide the strongest support to date for the nominal contracting hypothesis. None of the previous studies conducted such tests.

The results of this study provide support for the efficient market hypothesis and are in sharp contrast to the theory advanced by Modigliani and Cohn (1979). As mentioned above, Modigliani and Cohn have suggested that investors confuse real and nominal returns. This study showed that after converting nominal returns to real returns, the nominal contracting effects were detectable.

Note also that the nominal contracting variables considered in this study are part of the adjustment process to convert the reported accounting profits to their real values. When the nominal contracting effects are significant, this indicates that the market is not inefficient in the way predicted by Modigliani and Cohn and that investors are reacting according to the real values of earnings in a rational way.

Another important implication of this study is that a perfect hedge against inflation is very costly. Firms can use debt to hedge against the general price level risks and certain future contracts to hedge against specific price risks. In a perfect market, all risks can be hedged against. In the real world, future contracts might not be available for all commodities. The ability of firms to raise debt is also subject to many factors and in most cases, it is limited to a certain capacity. The borrowing capacity of a firm is related to the real value of its assets or to the market value of its common stockholders' equity. Both values are related inversely to inflation. Nevertheless, firms cannot increase their debt without increasing their market risks. Thus, debt cannot be used efficiently as a complete hedge against the general price level risks. Furthermore, investors like to assume some risks.

Nevertheless, the results of this study tend to support the theory advanced by Nichols (1968) and Motley

(1969). Nichols and Motley emphasized the role of the combined NMP and depreciation tax effects to explain the negative association between unexpected inflation common stock returns. As mentioned above, firms have limited capability in using debt to finance all their assets. As a result , the negative effect of the depreciation tax effect exceeds the positive effect of the NMP effect. Most of the empirical studies showed support only for the depreciation tax effect. This study and Bernard (1984) were the only ones to report evidence for both effects.

This study confirms also the mystery of the significance of expected inflation effect. Expected inflation was found to be significant most of the times. Its effect was ignored in this study.

6.2 Study Limitations

This study developed a multifactor model and extended it to test for the nominal contracting effects. So, the empirical results can only be justified within the limits of the asssumptions made in the model. Since the model utilized a stock market index as a proxy for the market portfolio, its analysis is subject to Roll's (1977) criticism of the single-index CAPM. The results of this study were found to be sensitive to the choice of the market index. The results obtained from models utilizing the Equally Weighted Index for the NYSE stocks were found to provide stronger results than those obtained from models utilizing the Value Weighted Index for the NYSE stocks. However, the Equally Weighted Index for the NYSE stocks was justified because the portfolios in this study were formed on an equally weighted basis.

The empirical results may also be sensitive to the proxies used for the expected and unexpected inflation components. Different proxies might generate different results. Until a unique model is found to generate the market expectations about inflation, not much can be done to avoid this problem.

The study is also limited by data availability. A subset of nominal contracting variables was used because data needed to measure some nominal contracting variables were not available. The estimation of the four nominal contracting variables considered in this study was also limited by the availability of data. For instance, the time horizon or the duration of all the nominal contracts that constitute a nominal contracting variable was ignored. This reduced the significance of the maturity effect tests.

6.3 Future Research

The study has left many unanswered questions which can be suggested for future research. A complicated and important question is the question of the expected inflation effect on individual common stock real returns. As mentioned above, this effect is in contradiction to rational expectations. Many studies have considered the effect of expected inflation on the aggregate stock market. The effect of expected inflation may be related to the effects of money supply or industrial production. In this study, the expected inflation was generated by a model that includes money supply and industrial production.

A second question can be raised about the validity of the multifactor model utilized in this study from an APT point of view. To empirically investigate whether the risk premia of the expected and unexpected inflation factors are significant and positive contributes significantly to the recently developed area of the APT. The risks of the relevant factors should be positively priced.

Finally, a question may be raised about how unexpected inflation can affect regulated firms, financial firms in particular. The financial firms have a completely different structure of assets and liabilities. The tests utilized in this study can be easily extended to test for the nominal contracting effects in different regulated firms.

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Vita

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